Linguistic Coordination in a Multi-Lingual Environment

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Declaration

I hereby declare that this thesis is entirely my own work and that it has not been submitted as an exercise for a degree at any other university.

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“Because everyone uses language to talk, everyone thinks he can talk about language”

Johann Wolfgang von Goethe

“What words say does not last. The words last. Because words are always the same, and what they say is never the same”

Antonio Porchia, Voces, 1943, translated from Spanish by W.S. Merwin

“Language is by its very nature a communal thing; that is, it expresses never the exact thing but a compromise - that which is common to you, me, and everybody.”

Thomas Earnest Hulme, Speculations, 1923

“A different language is a different vision of life.”

Federico Fellini

“It is not often that we use language correctly; usually we use it incorrectly, though we understand each others meaning.”

St. Augustine
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Abstract

This paper deals with the phenomenon of linguistic coordination between conversation partners, more specifically between a native speaker and a non-native speaker of a particular language (English or German). Through experiments relating to tangram figures, it highlights the sources, causes and extent of linguistic coordination and compares its form in ‘monogamous pairs’ to that in a ‘community group’. Moreover, it illustrates the effects on coordination of interacting in a multi-lingual environment rather than in a mono-lingual environment, and investigates the effect of language limitations on the emergence of a common sublanguage between conversation partners. Ramifications with respect to results in the literature based on comparable monolingual studies and for second language acquisition are discussed.
1 Introduction

When two people speak to one another, do they coordinate their language so that at the end of the conversation they both speak differently to how they did at the start? Do they adapt to their conversation partners speech and converge on referring expressions, so as to avoid a communication breakdown? Is a conversation simply the sum of individual monologues from each participant involved, or is it rather a special mixture and combination of each speaker’s utterances, ultimately resulting in a ‘common language’?

Linguistic coordination is the idea which underlies all these questions and is the phenomenon which I am going to investigate in this thesis. This can be researched in either a ‘mono-lingual’ or a ‘multi-lingual’ environment. A mono-lingual environment is one in which native speakers of the same language interact using this language in question. Alternately, a multi-lingual environment is one in which both speakers are still interacting in the same language; however, one of them is a native speaker of the language in question, whereas the other is a learner of the language in question. So, for example, a German native speaker interacting in German with an English native speaker learning German. It is in this latter type of environment that I am going to investigate linguistic coordination.

In Chapter 2, I review what the literature states about linguistic coordination. There are two main approaches to it: the ‘model approach’ and the ‘view’ approach. The ‘model’ approach distinguishes two models of dialogue: the “Collaborative Model” (Section 2.2) according to which collaboration develops a sublanguage which is clearly linked to the task and refined with time, and the “Input-Output Coordination Model” (Section 2.3) according to which a speaker tends to match the form of his utterances to that of the conversation partner’s utterances (Healey, 1997). On the other hand, the ‘view’ approach distinguishes three views on coordination: the “autonomous” view (Section 2.4) according to which collaboration plays no role and agents act completely autonomously, the ‘collaborative (or grounding) view’ (Section 2.5) according to which conversation partners collaborate to establish a common ground and the ‘mutual-modification view’ (Section 2.6) according to which coordination depends on conversation partners being able to modify each other’s utterances (Healey, Swoboda, Umata, & King, 2004).

So, a lot of research has already been carried out concerning linguistic coordination; however, it has mainly focused on linguistic coordination in a mono-lingual environment. In a multi-lingual environment, a certain amount of additional effort is naturally required on behalf of both speakers: the native speaker has to adapt to the linguistic limitations of the non-native speaker,
and the non-native speaker has to try and formulate his thoughts, in such a way that his utterances are comprehensible to the native speaker. Does this additional effort imposed by the new environment ‘drown out’ the normal linguistic coordination process between conversation partners, or does it simply accompany it? This is the question I set out to answer here, thanks to an experiment involving the ‘Tangram task’, which I will describe later, in Section 4.2.3.

In Chapter 3, I describe two pre-experiments, which I carried out initially. These were aimed at helping me plan the ultimate experiment, tune the experimental procedures and get an idea of what results I might expect to obtain from it. They were also based on tangrams (see Section 3.1 for an explanation of tangrams). The first pre-experiment (Section 3.2) aimed at finding out which tangram figures are difficult to construct and which are easier, and it allowed me to see whether the judgments I had made in this regard were correct or not. Eight participants were involved, divided into two groups, each group being assigned a different task, and each participant acting individually. It fulfilled its goal in that it indicated which figures I should expect to cause difficulties for the participants in the ultimate experiment. The second pre-experiment (Section 3.3) was very similar in its design to the ultimate experiment, thereby aiming at anticipating problems and results for the ultimate experiment. Two participants were involved, one French native speaker learning English and one English native speaker learning French, and they were assigned a tangram task, described fully on page 41, in which one speaker had to instruct the other speaker, as to the construction of particular tangram figures, using a piece of software called ‘MSN Messenger Service’. The results proved that a certain amount of linguistic convergence does seem to occur, but also that the task of instructing and constructing tangram figures is not as easy as it may seem at first. It takes quite some time for each figure to be constructed and, in this process, confusion and misunderstandings often arise. These two pre-experiments helped me design the ultimate experiment, so that it was neither too easy nor too difficult, and so that each participant involved was assigned an equally complex task. Its goal was to show what type and to what extent linguistic coordination occurred between German and English native speakers carrying out a tangram task, similar to that in the second pre-experiment.

In Chapter 4, I describe the exact design of the ultimate experiment. As was often the case in the experiments reviewed in the literature, I set up two experimental conditions: the ‘monogamous pairs’ condition (Section 4.2) and the ‘round-robin’ or ‘community-group’ condition (Section 4.3), so
as to see whether the extent and the intensity of the coordination depended on the conversational situation. Sixteen participants in total took part in the experiment, half of them German native speakers learning English and the other half English native speakers learning German; they all had an approximately equal second language level. They worked in pairs, one member instructing in his foreign language a tangram figure to the other member who had to accordingly construct the figure. Then, the roles switched, so that participants alternately instructed and constructed (see Section 4.2.3 for a comprehensive description of the task). The ‘monogamous pairs’ condition involved four pairs of participants, each pair consisting of one German native speaker and one English native speaker. They communicated using a collaborative text editor, described in Section 4.2.2. The ‘community group’ condition also involved eight participants, four German native speakers and four English native speakers. However, contrary to the previous condition, in which pairings stayed fixed throughout the whole experiment, in this condition, each participant was assigned a new conversation partner at the start of each round. However, the rule that each pairing was to consist of one German native speaker and one English native speaker was maintained. These pairs communicated using ‘MSN Messenger Service’, described in Section 4.3.2. The whole experiment took place in three sessions, each one lasting approximately two hours.

In Chapter 5, I analyse the data which I collected from the experiment, noting the similarities and the differences between the data collected from participants in the monogamous pairs condition and data from participants in the community group condition. Firstly, in Section 5.2, I rate the success in the task for the pairs from both conditions. Success is evaluated in terms of degree of correctness and degree of completeness of the construction achieved. This is based on photos which I took of the constructions at the end of each round, once the ten-minute time limit had been reached. Secondly, in Section 5.3, I analyse coordination and convergence between the speakers of the pairs from both conditions. I studied the conversations, noticing which participants tended to adopt expressions, which ones tended to rather introduce expressions, and to what extent they did either or both. Lastly, in Section 5.4, I review the comments made by the participants at the end of the experiment about their own performance, what they found difficult or easy, what they liked or disliked.

In Chapter 6, I discuss the results from the experiment, presented in the previous Chapter 5, under five particular headings, each time differentiating the two experimental conditions if relevant, as well as comparing and
contrasting my results from a multi-lingual environment to those in the literature about mono-lingual environments. In Section 6.2, I try interpreting the different success rates between the two experimental conditions; however this is made difficult by the differences being so minimal, and by the subjectivity of the ratings. In Section 6.3, I focus on the extensive use of figural-type descriptions by pairs from both conditions throughout the experiment, and suggest a possible reason for this. In Section 6.4, I analyse the conversation data collected under the perspective of the Input-Output Coordination Principle, developed in the literature, thereby studying occurrences of one participant tuning his output to the input received from the conversation partner. In Section 6.5, I review individual differences between participants, reflected in the types of attitudes which they adopt throughout the experiment. I suggest possible interpretations for them and attempt to correlate behaviour with performance. In Section 6.6, I discuss the phenomenon of grounding, defined in the literature as being the process through which speakers achieve mutual understanding, due to information explicitly or implicitly entering into their shared common ground. I mention examples which support grounding, and others which do not, and rather suggest it is not the only source of coordination.

In Chapter 7, I mention what I feel have been my achievements in this project (Section 7.1). In Section 7.2, I summarise the main conclusions I drew from this project and highlight the contribution made to the literature by setting a multi-lingual environment. Moreover, in Section 7.3, I suggest possible avenues for future research, which I would have liked to carry out had there been more time and resources at hand). Finally, in Section 7.4, I conclude this project with a few closing remarks.
2 Extant models of dialogue

2.1 Introduction

One question recurrent throughout the literature concerns how speakers manage to coordinate their languages, for the most part in mono-lingual environments. There are two main approaches in attempting to answer this question. The first one proposes two models to account for natural language dialogue (Healey, 1997): the “Collaborative Model” (Section 2.2), which suggests that collaboration between speakers leads to the emergence of a specific sub-language; and the “Input-Output Coordination Model” (Section 2.3), which suggests the existence of a basic coordination mechanism, the “Input-Output Coordination Principle”, thanks to which speakers converge on a common conceptual and terminological system. The second approach to answering this question consists in distinguishing three views of inter-speaker coordination (Healey et al., 2004). The first more traditional view, referred to as the “autonomous” view, states that addressees simply listen to and process the input they receive, rendering understanding a fully autonomous process (Section 2.4). The second one, the “collaborative” or “grounding” view, claims that conversation partners collaborate to ensure their common understanding of the topic in question (Section 2.5). The last one, the “mutual-modification” view, suggests that convergence on a particular scheme relies on the conversation partners’ ability to modify and repair one another’s utterances (Section 2.6). Yet, many of these different aforementioned models and views contain similar principles and ideas as shall be discussed in this chapter.

2.2 The collaborative model of dialogue

The first model identified by Healey (1997) is referred to as the Collaborative model of dialogue and has been mainly developed by researchers such as Clark and Wilkes-Gibbs (1986). Conversation and communicating are not as straightforward as one may think. According to Hirst, McRoy, Heeman, Edmonds, and Horton (1994), there are often “non-understandings” where the participant in question realises that he either cannot find a plausible interpretation for the utterance he has just heard or can find more than one plausible interpretation, or “misunderstandings” where the participant in question finds an interpretation for the utterance but does not realise that this interpretation is different from the one intended by the speaker. In this latter case, the conversation may break down, thereby signaling a misunderstanding, or the error may never be revealed. If the interpretation
error is made and detected by the same participant, it is referred to as a “self-misunderstanding”; if made by one participant and detected by the other, it is referred to as an “other-misunderstanding”. If such problems occur, the participants try to negotiate and determine the source of the problem, so as to repair it and continue the conversation. Common types of repair include “third-turn repairs” where one speaker explicitly informs the other speaker of his misunderstanding, or “fourth-turn repair” where one speaker realises without any external intervention that he had misunderstood something and subsequently corrects himself and replies in the right way (Hirst et al., 1994). Thus, full understanding of referring expression can only be achieved through active participation in conversation by all the speakers. This point will be discussed again later when contrasting the autonomous view and the collaborative view of inter-speaker coordination, in Sections 2.4 and 2.5.

Grounding is the process through which speakers achieve mutual understanding (Traum & Allen, 1992), thanks to information entering into the common ground throughout the conversation (Traum & Dillenbourg, 1998). Thus, the main effect of any conversation is a modification of the common ground between the two speakers, which should get bigger and stronger with time (Traum & Allen, 1992). According to Traum and Dillenbourg (1998), this is the result of communicative acts, called “grounding acts”. These can be of two kinds, either containing the contents of what is to be added to the common ground, or containing feedback referring to such utterances. Feedback can be positive if it is acknowledging the utterance to show that everything has been understood so far or negative if it is repairing the utterances or asking for more information if the speaker in question feels that this would help comprehension and thus coordination. The amount of grounding actions necessary depends on the local context and the purpose of the communication. It also depends on factors such as the persistence of the information or the cost of non-grounding. How important grounding a certain piece of information is is called the “grounding criterion”. Also studies have shown that the amount of grounding depends on the medium of communication: In normal dialogue, there will be more feedback given than in situations where the two conversants are communicating through a shared whiteboard. The question is: how is a person supposed to know how much to ground at any particular time?

It must be noted here that, according to O’Brien (2002), speakers can adopt one of two types of grounding strategies: an optimistic grounding strategy, in which both participants are optimistic about the mutual understanding of their utterances and the similarity of their common beliefs, or a pessimistic strategy, by which participants prefer to not take chances and
therefore wait for definite evidence of understanding on behalf of the other speaker before grounding their contribution.

The main model of grounding is Clark and Schaefer’s Contribution Model. They state that there are two phases to each contribution: the presentation phase and the acceptance phase. In the presentation phase, Speaker A presents an utterance ‘u’ to Speaker B. Speaker A can only assume Speaker B has understood what A meant by ‘u’ once Speaker B has given sufficient evidence for his understanding. This happens in the acceptance phase. Speaker B accepts the utterance ‘u’ by giving sufficient evidence that he has understood what A meant by ‘u’ (Oberlander, 2001). Here is an example taken from Oberlander (2001):

**Presentation phase**
Speaker A: well wo uh what shall we do about this boy then -

**Acceptance phase**
*Presentation phase*
Speaker B: Duveen?
*Acceptance phase*
Speaker A: m

Speaker B: well I propose to write uh saying. I’m very sorry I cannot - uh teach at the institute

According to O’Brien (2002), the speakers will not move on to another contribution until the utterances produced in the acceptance phase clearly demonstrate full understanding, or at least an understanding level sufficient for the purpose of the conversation (until the aforementioned “grounding criterion” has been reached). Others, such as Oberlander (2001), argue that the cycle will only come to an end thanks to the “Strength of evidence principle”, which states that “the participants expect that, if evidence e0 is needed for accepting word u0 and e1 for accepting the presentation of e0, then e1 will be weaker than e0.”. Therefore, the ‘strength’ of the evidence necessary for accepting an utterance progressively decreases, eventually reaching a level close to null, at which stage an utterance is directly accepted. If this were not the case, recursion would take place and the process would never end, as an utterance would never be accepted.

Understanding can be demonstrated in various ways depending on how strong or deep it is. According to Clark and Schaefer’s model, it can be
shown by:

1. display: if Speaker B repeats what Speaker A just said

2. demonstration: if Speaker B carries out what has been said or at least demonstrates some understanding

3. acknowledgement: if Speaker B says a phrase such as “ok” or simply nods

4. initiation of the relevant next contribution: if Speaker B starts the next ‘same level’ contribution

5. continued attention: if Speaker B shows continued attention to what A says

These five ways of giving evidence for understanding are listed from the strongest to the weakest, although it is debatable whether display (which involves repeating what the speaker just said) is really stronger than demonstration (which involves carrying out what has been said or at least demonstrating some understanding) (O’Brien, 2002).

This presentation-acceptance cycle makes use of the “Principle of Mutual Responsibility” and the “Principle of Least Collaborative Effort”. The latter states that participants try to minimise the work and effort that both put in when presenting and accepting an utterance. This minimisation is achieved thanks to their sharing a common perspective on the object(s) referred to (Heeman, 1991). The problem with such a principle and its consequent minimisation is that it assumes the participants share an approximately similar view on the world and its objects. For instance, if one says ‘a blue square’, he assumes that the other will interpret such an utterance in exactly the same way as he does, or at least in a way that is similar enough for common understanding. However, what would happen if the two conversation partners did not share this assumed world knowledge? Can this shared knowledge even be assumed at all? If an earthling and a martian were ever to communicate, would they be able to apply the Principle of Least Collaborative Effort, on the basis that they can assume a shared model of the world? One must not even refer to such extreme examples. There are earthlings who have no access to information about the rest of the world; how are they supposed to share a common model with the rest of the world? Could someone who has traveled a lot and has access to all the modern media, assume a common perspective on world objects when talking to someone, who has never seen or
heard about anything else than his own culture and people (regardless of the language barrier)? Even such simple words such as ‘winter’ mean completely different things for a Siberian than for a Senegalese.

Yet, Hurford (1989), in his paper “Biological evolution of the Saussurean sign as a component of the language acquisition device”, also supports the idea that speakers act according to the Principle of Least Collaborative Effort. He distinguishes three strategies towards communication:

- the imitator strategy: which consists in processing input similarly to how others have processed input and formulating output similarly to how others have formulated their outputs;

- the calculator strategy: which consists in evaluating how the others are formulating their outputs and then processing input according to this evaluation;

- the Saussurean strategy: which consists in a speaker formulating his output in accordance with how he processed his input.

According to the author, for successful communication, the Saussurean strategy has proved to be the most effective, demonstrating the usefulness of the Principle of Least Collaborative Effort. It is by formulating one’s own output according to the input received, that a stronger coordination is reached with the conversation partner, thereby leading to better mutual understanding.

The presentation-acceptance cycle is proved by the Tangram task, which has been carried out by many different researchers, in slightly varying forms. Tangrams are Chinese puzzles consisting of a square divided into seven pieces that must be arranged to match particular designs. I shall describe here the experiment carried out by Schober and Clark (1989), described in “Understanding by Addressees and Overhearers.”

The experiment involved ten pairs of students, none of whom previously knew each other. In each pair there was a “director” and a “matcher”. The director was provided with a sheet featuring the 16 tangram figures. The matcher, on the other hand, was supplied with a set of 16 cardboard cards, each picturing a different figure, such that there was one card per figure on the director’s sheet. They were seated such that they could not see each other, but could interact freely. The director had to describe each figure in such a way that the matcher could recognize it in his set of cards. The aim was for the matcher to order 12 of the 16 figures provided in the order indicated by the director, and this was to be done as quickly and accurately as possible. There were six trials, and the same figures were used throughout all the trials, though their order on the director’s sheet changed.
According to Kowtko, Isard, and Doherty (1991), task-oriented games are often used to analyse dialogue because turns do not last long, as the speakers try to converge on an understanding, and it makes it easier for an outsider to understand the function and purpose of each utterance. This is assuming that each utterance does have a function, which relates to the question of whether all language is functional, both the ‘bus stop’ language (“Nice day today, isn’t it?”) as well as the ‘survival language’. (“Be careful, there’s a tiger behind you about to leap on you!”)

Kowtko et al. (1991) decompose the dialogues produced by these tasks into “games”, some divided into other games. Such games typically involve an information giver and an information follower. A game starts with an instruction and finishes when it is clear that the listener has understood it. Each move within a game has a specific purpose, either that of checking comprehension, or asking for more information or acknowledging an instruction. Typically within one instructing game, there will be a querying game, in which more information is asked for, a checking game, in which the instruction follower checks he has understood correctly and an explaining game in which the instruction follower describes what he has so far.

Certain results can be predicted for such an experiment. For example, one would expect the dialogues in the early trials to be longer than in the later trials as the speakers have not yet established a common way of describing the figures. This is indeed what arose, as can be seen in the following example taken from Oberlander (2001), which refers to Figure 1:

Round 1: All right, the next one looks like a person who’s ice skating, except they’re sticking two arms out in front
Round 2: Um, the next one’s the person ice skating that has two arms?
Round 3: The fourth one is the person ice skating, with two arms.
Round 4: The next one’s the ice skater.
Round 5: The fourth one’s the ice skater.
Round 6: The ice skater.

By round 6, participants appear to assume a certain amount of common shared knowledge and therefore give less details than at the start. Emphasis is lessened when common ground is assumed.

Similarly, in the data which I obtained from my experiment, which I will describe in Chapter 4, the parallelogram is initially referred to as “the other green thing which is not a triangle” in the conversation but is finally referred to simply as “the green thing”. This clearly only works if the participants only have one green parallelogram, and possibly one or more green triangles.
If they had many different green shapes, or no green shapes, a complete misunderstanding would probably occur, which would either never be detected and thus simply lead to very poor task performance, or would be detected and therefore lead to confusion and questioning regarding which piece exactly was referred to by “the green thing”.

Furthermore, in data collected from such Tangram experiments, the presentation-acceptance cycle clearly appears as the directors give some referring description, and if it is understood, and thus accepted, by the matcher, he will show this by uttering an “acknowledge” move. This is an unelicited confirmation that the information has been understood and that the instruction giver can proceed, according to Kowtko et al. (1991). This acceptance was exemplified by the utterances in italics, in the data hereunder, which I collected from my own experiment, to be described in detail in the following chapter (see Chapters 4, 5 and 6). The data relates to Figure 2. (I have quoted the data ‘verbatim’, including all the typing mistakes and irregularities.)

Speaker 1: we will enlarge the house under the roof on the right side later
Speaker 2: *All right, go on.*
Speaker 1: take the blue square and put it on the right side of the square (made out of the green and yellow triangles) just on the bottom
Figure 2: ‘House’ tangram figure

Speaker 2: Ok,
Speaker 1: now you should have a space between the yellow thing and the blue square in form of another square, is this correct?
Speaker 2: This is indeed correct.
Speaker 1: fill this with a square made of the left two triangles, pink and blue and the pink has its corner (the short one) in the edge between the big yellow triangle and the blue square
Speaker 2: All right, I have that.

However, as I have discussed later in Chapter 6, the reliability of these judgments must not be taken for granted. Speakers often gave such unelicited confirmations of understanding, though when their final task performance was considered, they clearly had not understood, or at least not fully understood. It is a general fact that people tend to confirm understanding, simply to avoid conversational breakdown, or for social reasons, regardless of whether they have actually understood or not.

Moreover, a conversation is unfortunately not always as straightforward as the one exemplified above, especially in cases such as in the Tangram task where one speaker refers to or describes an object which his conversation partner does not know. In such cases coordination is harder to reach as they may not share beliefs about the world and definitely do not share beliefs about the object at the start (Edmonds, 1994). Furthermore, Heeman and Hirst (1995) add that this failure to identify the referring expression may simply be due to a lack of detail on behalf of the director. According to Clark and Wilkes Gibbs, if the matcher does not accept the utterance, he either “rejects” it or “postpones” his decision. Then, one of the two speakers tries to refashion it (for more information about specific types of refashioning, see page 13), and the utterance is re-evaluated. This process continues until the utterance in question has been accepted by the matcher. These ‘rejecting’
and ‘postponing’ attitudes show that, when the two participants try to refer to one same object, they typically have to collaborate (Hirst et al., 1994). This collaborating on referring expressions is said to be based on the planning paradigm, according to Heeman and Hirst (1995). For a referral to be successful, the speaker must provide enough information to the listener for him to identify the object (Hirst et al., 1994). What one speaker considers the most salient (i.e., prominent, striking, and recognisable) aspect of the object may differ from what the other speaker may consider as salient (Edmonds, 1994). So, for example, in the data collected from my experiment, some saw the right angle as the most important feature of a triangle, and based their descriptions on it; whereas others saw the hypotenuse as the most important feature of a triangle, and based their descriptions on that, thereby leading to completely different descriptions to the former ones, despite the object described being identical. Therefore, in some situations, if a misunderstanding occurs and is detected, negotiation is involved, which involves refashioning the referring expression, either by repairing it by correcting errors, or by replacing it (or at least changing or suggesting changes in it), or even by elaborating on the part of the speaker so as to provide more information (Hirst et al., 1994). The hearer may simply suggest certain refashionings if he or she is not confident enough to do them directly. This continues until both speakers are sufficiently confident that they are referring to the same object, even though a risk of error necessarily remains (Edmonds, 1994).

**Examples from my data for these three types of refashioning include the following.**

Once again, I have quoted the data ‘verbatim’, including all the typing mistakes and irregularities.

- **Repairing** (see Figure 3)
  Speaker 1: and the yellow piece shows to the left
  (...)
  Speaker 1: sorry to the right
  Speaker 2: yeah done

- **Suggesting change** (= “Replacement”) (see Figure 3)
  Speaker 1: Now take the yellow prallelogramm [sic], so that it contcts [sic] with its bottom left corner the top left corner of the blue square. It looks like the praallleogramm [sic] stands on top of the square corner.
  Speaker 2: is the parallelogramm [sic] pointing east or west?
  Speaker 1: Its pointing north-east.
Figure 3: Sample tangram figure

Figure 4: Another sample tangram figure

- **Elaborating** (= “Expansion”) (see Figure 4)
  Speaker 1: then add the yellow one so that its hypo [sic] points to the south
  Speaker 2: ... on top of the top side of the blue triangle, right?
  Speaker 1: no , next to the left part of the blue hypo [sic] that its peak makes one line with the left corner of the blue one

Referring to what was said above about the presentation-acceptance cycle using the Principle of Least Collaborative Effort, it is clear that there is a trade-off between uttering a referring expression and the process of refashioning it. One either spends a lot of time thinking up a good and complete referring expression, so as to subsequently limit the necessary refashioning, or, alternately, one simply utters a quick but incomplete referring expression
and then counts on a long process of refashioning before achieving success (Heeman, 1991).

Clark’s results show that speakers involved in a conversation develop a sublanguage which is clearly linked to the task at stake and which is refined with time, as mentioned by Rieser (1998). Heeman (1991) adds that this sublanguage leads to the collaborative effort being minimized.

Rieser (1998) also carried out an experiment and his findings were quite similar to that of Clark. The aim of his paper entitled “On Tops and Bottoms: Agents’ Coordination of Syntax Production in Dialogue” was to start investigating cooperative syntax productions in spoken language, and to see how agents initiate and maintain synchronisations in task-oriented dialogue. In the experiment an instructor had to give certain orders to a constructor to enable him to construct a plane; both could not see each other of course. To achieve the construction, they made use of various methods: self-correction, parallel syntax constructions in subsequent turns and overlap of verbal material, repair of dialogue, which clearly tie in and complete the refashioning processes stated above. This negotiation and collaboration led to the application of the principle of grounding and was influenced by that of the procedurality of speech. The latter states that one can make his utterances depend on a previous utterance which had already been negotiated by the conversants. A common ground to the two speakers was thus produced, combination of their individual utterances and of what cooperation “made them say”. The latter is composed of utterances which neither speaker ‘came up with’ in their exact current form but rather originated from one of the speakers and then had to be modified so that both participants agree on it. At this point, the utterance was added to the common ground.

Various computation models of dialogue have been attempted, but without much success due to the difficulty on the behalf of the user and on that of the system to know what the other participant expects to hear and also to be able to assess the level of understanding or the source of misunderstanding (O’Brien, 2002).

Traum and Heeman (1996) extended Clark and Schaefer’s Contribution Model by developing a “speech acts” approach to grounding. According to this, each utterance affects in a certain way the state of grounding of the contributed material. There are various types of speech acts: acknowledgement acts which confirm understanding, repair acts or requests for repair if full understanding has not yet been repaired. Furthermore, there are utterances which contribute new material. The latter type are evaluated to be “unrelated utterances”, whereas the former are called “related utterances” (with respect to the previous input). Therefore, to analyse the process of grounding according to this extension to the model, one must decipher each
of the utterances produced by both parties to examine what their respective functions are (in the grounding process) and in which way they lead to mutual understanding. It has been shown that these utterances typically occur in certain predefined sequences; however this is not a fixed rule. According to Traum and Allen (1992), their reason for extending Clark and Schaefer’s Contribution Model was that the latter divides a contribution into a presentation and an acceptance phase, without assigning a grounding function to each particular utterance, and this they considered too general and superficial. However, it is very difficult in general to establish whether or not grounding has happened. In many cases, it would superficially appear that grounding has happened because one speaker has confirmed understanding with an utterance such as “ok”, but on deeper analysis it appears that the grounding was only illusionary. Therefore, it would appear difficult to assign a grounding function to each particular utterance, when one cannot even rightly establish whether there was grounding or not.

Thus, another model of coordination was developed, which did not rely so much on grounding, thereby avoiding the problem of having to assign a grounding function to each utterance in the presentation and acceptance phases, but rather relied on the ‘simple’ coordination of one’s output with the input received.

2.3 The Input-Output Coordination model

Apart from this collaborative model of dialogue described above, Healey (1997) also distinguishes the Input-Output Coordination model as an account of natural language dialogue, mainly investigated in works by Garrod and Anderson (1987) and Garrod and Doherty (1994).

In a conversation, partners clearly demonstrate a tendency to match the form (and content) of their utterances to that of their partner’s utterances. This attitude reflects a basic interaction and co-ordination mechanism, originally proposed by Garrod and Anderson (1987) and referred to as the “Input-Output Coordination Principle”. Through this matching of the utterances, pairs of speakers tend to naturally converge on a common conceptual and terminological system. Thus, the effort in the communication process is minimised and the communication is made as efficient as possible (Garrod, 1997).

The main experiment used to demonstrate this coordination mechanism is the maze game experiment (Garrod & Doherty, 1994; Garrod & Anderson, 1987). 29 pairs of participants were involved, both members of each pair sitting in two separate rooms so as not to see each other. Each player had a screen in front of him on which one same maze was displayed, as can be
seen in Figure 5. Most pairs played two games, some three and some just one. The aim of the game was for both participants to move their markers along the paths in the maze so as to reach their goal positions, marked by a ‘*’ on the figure. Of course each player could only see his own start and goal position, and his position marker, marked by ‘X’ on the figure. The game was made cooperative by the presence of gates which could block certain paths depending on their location (see short bold lines on the figure), and the presence of “switch nodes” (marked by ‘S’ on the figure), which if entered by player 1 removed all the gates on player 2’s board, and placed new gates on the paths that previously had none. The gate configuration and switch box configuration was different on each screen. Thus if a gate was interfering with player 1’s access to his goal position, he had to direct player 2 into a switch node (only visible on his own screen) so that his gate configuration would change. In certain versions of the experiment, a maze monster was added to further elicit coordination between the players; the monster pursued one of the players on the board and if it ended up on the same node as the player’s position marker, the player was considered to be ‘eaten’ and the game terminated.

Each game consisted in both players trying to reach their respective goals, while communicating to open gates and thus gain access to the necessary paths. They, therefore, had to achieve common referring expressions for their respective position markers, their goal positions as well as the location of the switch nodes; these referring expressions were all part of a certain “description scheme” which the players had to converge on, in a situation in which referential points were not fully shared. Each description scheme was associated with a specific mental model (of the board), so both speakers appeared to agree on this mental model and on a shared language, the former sharing of course indicated by language conclusions and lack of debate, as well as task success to an extent. Their directions and hence their task was only successful if this was achieved. As defined by Garrod and Anderson (1987, pg. 203), language is a “set of rules for mapping expressions onto interpretations with respect to a common model of the discourse domain.”

For the maze game various schemes of description emerged:

- **path descriptions**, see Figure 6
  here, the listener is asked to follow a path described by the speaker: “See the bottom right, go two along and one up.”

- **co-ordinate descriptions**, see Figure 7
  here the speaker considers the board as a matrix and establishes a co-ordinate scheme for the nodes on the board.
Figure 5: Sample boards from the maze game
“I’m on the third row and fourth column.”
or “I’m at C4.”

- **line descriptions**, see Figure 8
  here the speaker indicates a particular line to the listener and then, on
  that line gives the position of the relevant node starting from the left
  or from the right
  “Third bottom line, third box from the right.”

- **figural description**, see Figure 9
  here the listener detects certain figural ‘shapes’ within the node con-
  figuration and uses them as referral points:
  “See the middle right-turn indicator. I’m on the end of it.”

The study mainly served to answer the question: how do speakers coor-
  dinate their language so as to communicate intelligibly?
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Figure 7: The “co-ordinate” description scheme

Figure 8: The “line” description scheme
Figure 9: The “figural” description scheme
Many predictions have been made about the various processes involved. Shelling (1960) suggested that players tend to choose the most salient option, that is, the one which at a given time and in a given situation seems the most obvious to choose, and which one would expect others to choose. Schiffer (1972) suggested that players tend to opt for the solution (or scheme of description in this case) which was previously used. Lewis (1968) suggested the idea of a conventional choice, by which all speakers will naturally make use of the previous course of action, and which will thereby increasingly become the most salient course of action. The results of the maze game show that, at first, the speakers choose the most salient schemes (such as the path description scheme) but then, as they start ‘coordinating’, they move on to more abstract schemes (such as the coordinate description scheme). To converge on a common scheme, the players could explicitly communicate with one another either at the start or during the game to say what description scheme they were going to use. But this showed not to help achieve coordination because it is a very ‘unstable’ means of converging on a common scheme; whatever scheme of description a pair of players decided to use was never prevalent for a very long time in their dialogue.

Therefore, speakers must make use of a different means of coordination, which does not involve explicit negotiation: this coordination relies on the “Input-Output Coordination” Principle. Each speaker must formulate his output in accordance with the input he has just received. This is consistent with what Hurford (1989) referred to as the “Saussurean strategy” towards communication. He stressed the point that this was not the only possible strategy towards communication; there was also the “imitator strategy” and the “calculator strategy”. However, the “Saussurean strategy”, whereby a speaker formulates his output in accordance with the input received, proved to be the most effective. Abiding to the “Input-Output Coordination” Principle has certain drawbacks as it leads to quite an ‘inflexible’ dialogue and it can take a few rounds to achieve coordination. However, it shows the minimal common ground which is needed to communicate effectively.

So, according to Garrod and Anderson (1987), the general convention established at the start only yields a default meaning; it is then overwritten by more local conventions due to interaction between the speakers. As Healey (1997, pg. 4) remarks:

[Figural descriptions call] only on the pre-established linguistic coordination that each individual brings to the task in the first place whereas Matrix [=“co-ordinate”] descriptions call on local, more specific conventions established during the course of the task.
Following this study, Garrod and Doherty (1994) repeated the maze game experiment but extended it by adding a new feature. The same number of pairs were used, this time each participant playing nine games. About half of the pairs stayed identically matched throughout the games, they were referred to as the “isolated pairs”. (These replicated the aforementioned experiment by Garrod and Anderson (1987).) The remaining pairs were all part of one community group. At each new game, each member of the community group was assigned a new partner also taken from this closed community group. Thus, players from this second group encountered nine different game partners. The aim of their study was to see where a common language was first established, in isolated pairs where partnerships remain the same throughout the games or in a community group where one constantly switched partners?

In both situations, the convergence between the players of each pair was observed, and was clearly due to input-output coordination processes (Garrod, 1997). A speaker coordinates his output with the way in which he processed the input just received. According to Healey (1997), in the maze game, if the two speakers’ description schemes differ, they will switch to the description scheme which they had both used most often so far. It is through this matching process and conflict resolution technique that semantic variation can be overcome in a conversation. However, on a more detailed analysis of the results, Garrod and Doherty (1994) noted that isolated pairs converged quicker on a common scheme but their convergence was not very stable. They eventually reached a maximal coordination level. In these isolated pairs, converging depended on the aforementioned processes of salience and precedence, which were both context sensitive. These are called “local coordination” processes, and lead to local description sub-languages which encourage coordination. On the other hand, in the community group, pairs of players were less coordinated in the early games as the isolated pairs were. It clearly took longer in this situation for a common language, and hence a common description scheme to appear. The reason for this is that the group has to first establish a community-wide convention between all its members. Only once this is done can they all act according to this convention, and coordinate as a group. Finally their convergence was much stronger and their language was much more stable, than it was at the end of the task for the isolated pairs, despite their encountering a fresh new partner at each new game. Garrod (1997) adds that whichever scheme of description was most frequently used across the community (corresponding to the one which was more appropriate for the task) ended up being the scheme all the players converged on. The community group is said to act according to a “global coordination” process, which related to Lewis’ conventional choice idea and
which, according to Garrod and Doherty (1994, pg. 186) is “sensitive to constraints on convention”.

Garrod and Doherty (1994) then suggested that this increased inter-speaker coordination was possibly due to the fact that they encounter a fresh partner at each round, and thus they all settle for the more ‘conservative’ coordinate scheme. If this were the case, then, in the “community group” setting, whether the players in the pairs were drawn from one same closed community or not should make no difference. To investigate this, they carried out a second experiment, in which the partners were not drawn from the same community. The results showed that the coordination observed in such conditions was clearly inferior to that observed in the situation in which partners were all drawn from a closed community. Thus, it can be inferred that this “global coordination process” only occurs if the different partners are all from a closed community and it does not simply depend on being confronted with a fresh partner at the start of every game.

Other experiments were also carried out to prove the same point. Appel and Vogel (2001) carried out an experiment in which participants (half native English speakers and half native Spanish speakers) were asked to do the ‘Tangram task’. This task is very similar to the one which I used in my experiment, which I will explain in Section 4.2.3. Participants are paired up (one English native speaker with one Spanish native speaker) but can neither see each other, nor see what they are doing. One is the instructor and is provided with a sheet of Tangram figures, and the other is the constructor and is provided with a set of Tangram construction pieces. The instructor must instruct the constructor in his foreign language about the construction of each Tangram figure, so that the constructor is able to reproduce the figure which is drawn on the instructor’s sheet. Furthermore, as in the maze experiment, certain participants always interacted with one same partner; others were part of a community group and changed partner at each new game. A specific e-mail server was built to permit interaction between the speakers. On the corpus of learner language data that the server collected, a series of statistical analyses were carried out. Part of the interest of this experiment is that half of the dialog was English, the other half Spanish; so not only the effects of the experimental condition were investigated (monogamous pair or community group), but also the effects of interacting in two different languages, the native language and the foreign language. The results showed that, in the isolated pairs, the language used in the final games was very similar to the one they used in the early games; whereas in the community group, the language used at the end was quite different to the language they used at the start. This was further shown by results indicating that the speaker’s language is affected by every new partner encountered. However, it was also shown that
on a whole, in the community group, the language used by each individual speaker was closer to the language of the entire community; whereas in the isolated pairs there was a more significant difference between the language used by each particular speaker and the language used by the group as a whole.

In both of these experiments, the Input-Output Coordination Principle was clearly employed, whether the interaction took place in one language or in two. When a Speaker B hears a certain utterance ‘u’ produced by Speaker A and processes it, he automatically interprets it in a certain way and thus takes a certain ‘view’ on it. If Speaker B then formulates his next utterance in accordance with this newly formed interpretation, and this process is repeated, their ‘mental models of the situation’ will eventually match, a common ground will be established and thus coordination will be reached. Hence, it is by dynamically coordinating their respective inputs and outputs that the speakers achieve coordination (Garrod & Doherty, 1994). One drawback of this principle, however, is its inflexibility. Indeed, it is difficult to change the common ‘mental model’ which has been established between the two speakers, as each utterance simply follows in a coordinated manner from the previous one. Moreover, one may rightly ask whether there really is such a thing as a ‘common mental model’; yet, this is certainly assumed by many. According to Oberlander (2001), the only ways to change it are either through explicit negotiation, or if one of the two speakers decides to take the lead and changes it himself. This disadvantageous feature of the Input-Output Coordination Principle was also seen in the data from the maze game experiment, whereby pairs of participants tended to stick to the one particular description scheme throughout a game, thereby possibly demonstrating the lack of such a ‘common mental model’. However, it must be reminded that the Input-Output Coordination Principle alone cannot account for the convergence between pairs in the community group situation. Here, being part of a community also plays a role, as was shown in Garrod and Doherty’s second experiment.

Finally, it has been noted that coordination in accordance with the Input-Output Coordination Principle also occurs in everyday life. This can be seen, for example, through syntactic priming, meaning that if a speaker is hesitating between two formulations for a particular utterance, he will use the structure which has been used most recently, thereby minimizing the collaborative effort (Oberlander, 2001). This tendency to imitate is prevalent through all stages of life; even very young children naturally imitate sounds and gestures which they hear or see. Actually, not demonstrating this imitation behaviour is used as a diagnosis for autism in children. It seems that imitation behavior is one of the foundations of linguistic ability. As Cresti
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and Moneglia (1995, pp. 3-6) state in their paper “Monological repetitions in very early acquisition”:

In early dialogue another procedure leading to nonsemantic turns may be found, one which must be distinguished from the previous protolinguistic devices. Formally it could be considered as a child’s dialogical repetition of an adult item, but such early linguistic behaviour must be evaluated as a particular kind of imitation. We call this phenomena copying. Imitation concerning, for instance, facial and hand gestures is present in human beings from their very first weeks of life. Later, after six months in the babbling period, the child starts to be able to do imitations of adult verbal production too, especially if these are of a very simple nature. Such behaviour can be defined as kinds of prelinguistic routines, with vocal exchange with the adult, and it has already been considered extremely significant for language acquisition (see Ninio and Bruner 1978; for a recent report Snow 1986), but it must be qualitatively differentiated from the dialogical copying we are talking about. (...)

This fact can be described as lacking a specific informational function, even though it must be pointed out that if a child copies an adult item or formula, in any case s/he is behaving in a cooperative way toward the dialogue, since s/he at least takes her/his turn with something s/he conceives as linguistic ‘stuff’, and shows her/himself to be very attentive to the dialogue. Copying becomes frequent in dialogue not at a very early period, as one might think, but on the contrary when the child starts to possess a relatively stable and rich phonological system and a fairly abundant lexicon, since a certain notion of words is needed. At this level of language acquisition, copying is a relevant part of early infant dialogue.

However, this division of natural language coordination mechanisms into two accounts: the “Collaborative Model” and the “Input-Output Coordination Model” is not the only classification prevalent in the literature. Another way of identifying the various types of inter-speaker coordination according to Healey et al. (2004) is to distinguish three main views: the “autonomous” view (Schober & Clark, 1989), the “collaborative” or “grounding” view (Clark and Schaefer, 1987) and the “mutual-modification” view (Healey et al., 2004). These three views point to an answer to the question of what is needed for successful conversation. However, parts of the contents of these views also appears in either of the two accounts described previously, except
for the third view, the “mutual-modification” view, which includes the new idea that coordination depends on the participants being able to repair and modify each other’s utterance.

2.4 The “autonomous” view (Schober and Clark, 1989)

One of the fundamental questions asked by researchers in the field concerns whether speakers act autonomously or whether they try coordinating with the utterances of their interlocutor for the conversation to be successful. The autonomous view arose from this question as one of the possible processes of understanding. According to this more traditional line of thought, the addressees simply listen to and process the input they receive, in accordance with what they think is the common ground of the participants.

To prove whether agents acted totally autonomously as the view suggested, or whether agents tended to interact and collaborate so as to reach coordination, Schober and Clark (1989) carried out experiments involving overhearers. Overhearers are agents who hear the whole conversation but may not intervene in it, that is, they cannot make any remarks or ask any questions; however the input they receive is identical to that received by the actual conversants. The aim of the study was to show whether overhearers were at a disadvantage compared to direct addressees. The autonomous view predicts that, assuming certain conditions hold, an overhearer should be just as able to understand as an addressee. If participants in a conversation act fully autonomously and do not interact or collaborate in any way, then whether they are allowed to do so (as are direct addressees) or not (as in the case of overhearers) should make no difference at all on the final understanding. Alternately, the “collaborative” view predicts that the overhearer will be at a disadvantage, as this view states that collaboration is vital to successful understanding, but overhearers are forbidden to collaborate. Two experiments were carried out where both an addressee and an overhearer had to do the same Tangram task as the one used by Schober and Clark (1989) to prove the existence of a presentation-acceptance cycle in their Contribution Model described on page 9. Pairs of speakers were matched; in each pair there was one director who was provided with a sheet of Tangram figures, and there was one matcher who was provided with a set of cards picturing the figures on the director’s sheet. The director had to describe each figure in such a way that the matcher could find the correct card picturing the described figure. Furthermore, the full conversation between each pair was recorded and later played back to other participants who were thereby acting as overhearers. Certain overhearers heard the conversation through all the
trials, others only heard the conversation from the third trial onwards. The overhearers were also matchers, they had the same set of cards as the actual matchers, and were assigned the same task as the actual matchers. Half the overhearers could use the ‘pause’ button on the tape recorder whenever they wanted, the other half could not. The main measures of understanding which were calculated were the time that each overhearer took to complete the task (in comparison with the time that the actual matcher had taken) as well as their accuracy in the task, that is, how many of the described figures had been correctly matched, in comparison with the number of figures that the actual matcher had recognised.

The results showed that overhearers were less accurate in their matching of the described figures. This was to be expected in the case of the late overhearers because they missed out on the beginning of the conversation which is typically when speakers establish the common ground and the conventions they are going to use in the future. However, this decreased accuracy also appeared in the case of the early overhearers, who assisted to the full conversation and therefore should also have shared the same ‘common ground’ as the participants. Hypotheses as to why this occurred could be formulated: Is this decreased accuracy due to the overhearer not physically attending the conversation but just listening to a recording of it? Or is it due to the overhearer not being able to ask questions and communicate as a whole with the instructor? Furthermore, there was no essential difference noted in the accuracy of matching between the group of overhearers who were allowed to pause the conversation, and those who were not, which indicates that the decreased accuracy of the overhearers compared to that of the actual matchers was not due to lack of time or inability to pace the conversation. To check that this decreased accuracy was not simply a result of not directly overhearing the live conversation, but rather of listening to a tape, a further experiment was carried out which only differed in that the overhearers were present in the room, simply divided by visual barriers. However, the results of this experiment were very similar to those from the previous experiment in that the matching accuracy was largely decreased, thereby demonstrating that it was the ability to communicate that overhearers were lacking, and not just the situational context. The only difference was that overhearers did seem to be disadvantaged by their inability to pace the conversation. When asked what they thought of the experiment, they commented on their disadvantage: they “couldn’t communicate with the players”, “couldn’t ask questions to clarify some of the shapes”, or were “forced to rush on to the next figure whether or not I’d gotten the previous one.” (Schober & Clark,

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1There were six trials in total.
On a whole though, both experiments distinctly indicated that communicating with the speaker is a vital element for successful understanding. It is because this is impossible for overhearers that they complete the task less accurately; overhearers do not have the opportunity to participate in the ‘grounding process’. This clearly proves the autonomous view to be wrong. Understanding is not simply an autonomous process in which collaboration with the speaker plays no role (Schober & Clark, 1989).

These flaws in the autonomous view were further demonstrated in the Music Drawing Task developed by Healey et al. (2004). Using this task, they attempted to explore the influence of interaction and of experience on (graphical) communication. Users were paired together and each had a whiteboard; they both heard a two-minute piece of music and had to represent what they heard on the white board without using numbers or letters. Like in the maze experiment described on page 16, the music drawing task involved two different conditions: half the pairs were all drawn from one single community group and were referred to as the “within-group” pairs, the other half were drawn from different sub-groups and were referred to as the “cross-group” pairs. From the representations they drew, each pair had to decide whether the piece of music they had both heard was the same one or a different one. The three main drawing types which emerged were referred to by Healey et al. (2004, pg. 6) as: “abstract” types consisting of “graph-like representations of parameters of musical form”, “figurative” types “depict[ing] recognisable objects, figures or scenes”, or composite types combining the two aforementioned types. According to the autonomous view, each member individually chooses the mode of representation which he thinks is the most salient, that is, the drawing type which he thinks is the most effective representation for each piece. Thus, the autonomous view ties in with what were referred to previously as the “local coordination processes” (salience and precedence) which operate in isolated pairs in the maze game. According to this view, participants are subject solely to local coordination, they decide themselves (and autonomously) which mode of description is the most salient; however everyone does not share the salience. In the case of the Music Drawing Task, it is assumed that the most salient drawing type is the abstract type, as it provides a more suitable solution for such a task. Thus, if the autonomous view is to be proved right, it should be the case that all participants choose the abstract drawing type, whatever experimental condition they are in. Indeed, the results proved that in the “within-group” condition, the pairs usually did converge on more abstract representations. However, in the “cross-group” condition, pairs tended to adopt rather figurative rep-
resentations. If agents just acted autonomously regardless of whom their partner was and what their partner did, then there should be no difference at all between the representations drawn in the “within-group” condition and those drawn in the “cross-group” condition. Therefore, the fact that there is a difference between both types of pairs clearly goes against the autonomous view hypothesis.

Thus, it appears that the autonomous view is proved false by many experiments, and cannot be taken for a justifiable account of how speakers inter-coordinate.

2.5 The “collaborative” or “grounding” view (Clark and Schaefer, 1987)

Until recently, there were only two views on the process of understanding: the “autonomous” and the “collaborative” view. According to the collaborative view, the addressee actually collaborates with the speaker to ensure that they are both clear about what is being said and share a common perspective on the topic: this is called the “grounding” process, and was described at length in Section 2.2 of this chapter when discussing the “Collaborative Model” of dialogue. Experiments, such as the ones I described previously in Section 2.4, were carried out, which tended to show that the “collaborative” view was more reliable than the “autonomous” view.

Schober and Clark (1989) used overhearers in their study to support the fact that the autonomous view did not hold, but rather the collaborative one did. They aimed to see whether overhearers were at a disadvantage compared to direct addressees, as far as understanding and, thereby, successful achievement of a task were concerned. Results showed that overhearers were less accurate than the direct addressees. This indicates that agents do not simply act autonomously in the process of understanding, as suggested by the autonomous view, but rather need to collaborate with one another so as to reach a common understanding. They need to be able to participate in the grounding process, and thereby establish a sublanguage which is specific to the conversation and necessitates less use of general knowledge. Thus the collaborative view of understanding is proved right.

Healey et al. (2004) used the Music Drawing Task to test which view of inter-speaker coordination was trustworthy. Firstly, the simple fact that pairs tended to match each other’s choice of drawing type seemed to contradict the autonomous view and support the idea that interaction between the participants played a role. Furthermore, as I explained previously in Section 2.4, due to the differences observed in the drawing type choices of the “within-group”
pairs compared to those in the “cross-group” pairs, the autonomous view was proved wrong, and the collaborative view on inter-speaker coordination gained support. The latter states that the two members of the pair will try to converge on one common coordinated language for the task by interacting with one another. As mentioned previously in Section 2.4, it is assumed that in the Music Drawing Task, the abstract drawing type is the most salient and efficient choice. Thus, the fact that the use of abstract drawings was “destabilised” in the “cross-group” pairs and alternately that the “within-group” pairs tended to all converge on this drawing type tended to support the idea that the abstract drawing type could only be sustained throughout the experiment if pair members could interact and thereby collaborate with one another. Therefore, it is clear that it is the history of interaction in the group which influences the pair’s choice of drawing type, and it is from this particular history of interaction that a group-specific convention arises. This ties in with what was referred to on page 23 as the “global coordination process” which operates in a community group in the maze game experiment. According to Healey et al. (2004, pg. 18), this raises two questions: “how is interaction contributing to the emergence of the community specific conventions and why is this effect specific to Abstract drawings?”

This collaborative view therefore draws on both accounts of natural language dialogue described previously: the “Collaborative Model” of dialogue and the “Input-Output Coordination Model”. It is also tightly linked with the Principle of Least Collaborative Effort, as it has been shown that with time, participants refine a sublanguage for a particular task so as to minimize the effort needed for comprehension. This leads to the question of why pairs move towards economy. According to Oberlander (2001, pg. 24), this Principle of Least Collaborative Effort can be “approximated by a simple heuristic as Input-Output coordination” (see Garrod and Anderson (1987) described in Section 2.3, page 16). Thus, the collaborative view not only draws on both aforementioned models of dialogue, but also links them together, making them interdependent.

### 2.6 The “mutual-modification” view (Healey et al., 2004)

The third hypothesis concerning the types of inter-speaker coordination involved, alongside the “autonomous” and the “collaborative” views, is the newly emerged “mutual-modification” view developed by Healey et al. (2004). It states that convergence on a particular scheme relies on the participant’s ability to modify and repair the utterances of his partner. This idea emerged from the fact that pairs tended to converge more on abstract drawings than
on figurative drawings. The main difference between abstract drawings and figurative drawings are that abstract drawings have a “proto-compositional structure”, meaning that each part of the drawing represents a certain part of the music, contrary to figurative drawings which simply represent the music on a whole. Thus, if participants were allowed to use graphical devices such as arrows, underlining or circling so as to annotate and modify each other’s drawings, that is, if participants were allowed to interact, their convergence on the abstract drawing type would be much stronger. This is what the mutual modification hypothesis suggests.

Therefore, after the initial Music Drawing Task where interaction was free, another similar task was carried out, in which various constraints on the participants’ possibilities of interaction were imposed, so as to see if this influenced their choice of representation. The whiteboard was divided into two sections, each section corresponding to one of the participants’ drawings. (So at all times both members of the pair could see what the other was doing.) Examples of constraints included “blocking”, meaning that each participant could only annotate and edit his own drawing, not his partners, and “transposition”, meaning that when subject A drew in the top half of his screen, Speaker B saw it in the bottom half of his screen. This made aligning each other’s drawings more complex.

Results showed that in the ‘constrained’ conditions, pairs tended to use more figurative drawings rather than abstract drawings. Therefore, changing the kind of interaction permitted clearly influenced the choice of drawing type. Healey et al. (2004, pg. 19) state that

> When these [manipulation] mechanisms are unavailable, people appear to be unable to sustain the level of semantic coordination necessary for the Abstract drawings and rely instead on a more ‘holistic’, ad hoc, Figurative strategy.

A direct link seems to emerge between the types of interaction available to people and the types of drawings they choose. It must be reminded that throughout all the various experimental conditions, participants were always allowed to edit and annotate their own drawings; the constraints only affected the editing of the partner’s drawing. This means that it was the coordinated editing of one another’s drawings which affected the type of representation used. Furthermore, through interacting and thanks to the coordination which follows, a shared group-specific system of symbols and ‘sub-language’ seemed to emerge with time. So, after imposing constraints on the interaction mechanisms allowed, the third hypothesis appears the most conclusive. Participants coordinate thanks to their ability to mutually modify each other’s drawings.
It remains to be proved whether what applies for graphical language also applies for natural language. If this were the case, then Healey et al. (2004) suggest that extending the interaction possibilities between humans (through an amelioration of technology) should have an effect on human natural language in use, and possibly lead to a richer and more complex language.

2.7 Conclusion

In this section, I have reviewed the two main approaches to linguistic coordination which appear in the literature, according to Healey: the ‘models’ approach (Healey, 1997) and the ‘views’ approach (Healey et al., 2004). I started by describing the first approach to coordination in natural language dialogue which consists in discerning two different models of dialogue: the “Collaborative Model” (section 2.2) and the “Input-Output Coordination Model” (section 2.3). Then, I detailed the second approach to linguistic coordination which covers three separate views: the “autonomous” view supported by Schober and Clark (section 2.4), the “collaborative” or “grounding” view supported by Clark and Schaefer (section 2.5) and the “mutual-modification” view supported by Healey et al (section 2.6). However, both approaches are interdependent and often contain similar or identical ideas and theories. Only the autonomous view does not really tie in with any other view or model, as it denies coordination. Also, the latter mutual-modification view provides a new perspective which had not been mentioned in previous literature.

Most of these hypotheses were formulated concerning linguistic coordination in a mono-lingual environment, that is where both speakers have the same native language and are communicating through it. I set out to investigate linguistic coordination in a multi-lingual environment. In such an environment, both speakers are still speaking the same language; however, one of them is a native speaker of the language in question whereas the other is a learner of the language in question. Thus, a certain amount of additional effort will be required on behalf of the both speakers: the native speaker will have to adapt to the linguistic constraints of the non-native speaker, and the non-native speaker will have to ensure that his utterances are comprehensible. The question to be investigated is whether this additional effort set by the new environment will ‘drown out’ the normal coordination process between the speakers, or whether it will simply accompany it.
3 Pre-Experiments

3.1 Introduction

Prior to carrying out my ‘real’ experiment aimed at investigating the phenomenon of language coordination, I set out to organise two pre-experiments, so as to help my planning of the ‘real’ experiment, tune the experimental procedures and get an idea of what results I might expect to obtain from the latter. Both involved tangram figure construction. As a reminder, tangram sets consist of seven pieces, all cut out of the one square: 2 big triangles, one medium triangle, 2 small triangles, one square and one parallelogram, as can be seen in Figure 10. By assembling all the pieces in particular ways, various figures can be formed, such as Figures 11 and 12.

![Figure 10: How to cut out tangram pieces](image)

The first pre-experiment (Section 3.2) is very basic and its design is very different to that of the real experiment. It involved manually constructing tangram figures without any form of interaction or dialogue, thereby rendering any form of language coordination clearly impossible. However, it plays
Figure 11: An example Tangram figure

Figure 12: Another example Tangram figure
an important role in evaluating which figures were easy or hard to construct, so that I could then design sheets of equal complexity for the ‘real’ experiment. The second pre-experiment (Section 3.3) is much more similar in its underlying idea to the real experiment, except for the scale which is distinctly smaller as it only involves two participants whereas the real experiment involves sixteen participants. Moreover, it looks at language coordination between French and English native speakers, whereas the real experiment looks at language coordination between German and English native speakers. Yet, despite these differences between both pre-experiments and the ‘real’ experiment, they definitely were relevant and their results served their purpose, in helping me design, anticipate difficulties and make hypotheses concerning the ‘real’ experiment, whose exact set-up I shall describe in Chapter 4. It must be further noted that each participant only took part in one task: the first pre-experiment, the second one or the real experiment.

This chapter details the role of the pre-experiments in formulating the ultimate experiment.

3.2 Pre-experiment 1

*Goal: assign to each figure a rating of difficulty of construction*

3.2.1 Setup

This first pre-experiment was carried out in November 2004. It involved eight subjects: four English native speakers and four German native speakers, all aged between 21 and 55 years old. They were confronted with the task of constructing nine tangram figures, while being timed with a stopwatch. Their aim was to complete the task in the least time possible.

Group 1 consisted of four participants (two English native speakers and two German native speakers). They were each given a sheet on which just the outlines of the nine figures to be constructed were drawn (see Appendix A, page 140), such as in Figure 13.

Group 2 (the four remaining participants) were each given a sheet on which the outlines of the seven constituting shapes in each figure and the outlines of the nine assembled final figures were drawn, so that they effectively just had to copy exactly the ordering of the shapes on the sheet in order to reconstruct the figure (see Appendix B, page 142), such as in Figure 14.

To make the task more difficult for Group 2, certain features were added. The first one was that, because the pieces were of all different colours, they not only had to find a piece of the same shape as the one on the sheet, but
Figure 13: An example figure given to Group 1

Figure 14: An example figure given to Group 2
they also had to make sure it was of the right colour. The second additional feature was that one extra piece, which would never actually be used throughout the experiment, was added to the set of shapes. This rendered the selection of pieces by ‘elimination’ impossible: for instance, if an extra medium-sized triangle was added, then when placing the medium-sized triangle in the figure, the participant would still have to make a conscious choice between two alternatives: the extra triangle or the other triangle left; also when placing the final piece in the construction, the participant would have to make a conscious choice between the extra piece and the other one left.

Furthermore, two different sheets of tangram figures were used, so that half of Group 1 (one English native speaker and one German native speaker) and half of Group 2 (one English native speaker and one German native speaker) were given a certain set of figures (referred to as ‘Sheet 1’) with or without inner lines depending on their respective groups, and the remaining four participants (the remaining half of Group 1 and the remaining half of Group 2) were given another set of figures referred to as ‘Sheet 2’. However, both sheets (that is, both sets of figures) were designed to be of equal complexity, which was further proved by the participants’ performance times. Complexity was initially measured by subjective judgements as to the difficulty of construction of particular tangram figures, and these intuitions were then verified in this pre-experiment, as discussed in this section. For the task presented to Group 2 (with the inner lines), the fact that all figures were not equally difficult was not very relevant. However, for the task presented to Group 1 (with just the outlines of the figures), outlines where certain of the shapes were clearly identifiable such as Figure 12 would probably be easier to construct than more ‘compact’ figures where the assembling of the seven pieces must be self-induced, such as Figure 11. The construction times reflected these judgments.

Each participant was given a sheet with nine figures on it and a set of pieces (seven or eight of them depending on the task). They were told to construct the nine figures one by one. Group 1 could proceed through the figures in any order they wanted to; Group 2 was asked to follow a specific order. The whole task was timed using a stopwatch, so that both the individual construction times for each figure as well as the overall performance time were recorded.

### 3.2.2 Results

The results were quite predictable in that Group 2 achieved much better construction times than Group 1. The average performance for the nine figures in Group 2 was 6 minutes 29 seconds, whereas the average time for
Group 1 was 25 minutes 54 seconds when using the performance times of only three participants, and 34 minutes 17 seconds when adding in the fourth (who however did not terminate the experiment due to exasperation after 80 minutes!) This is naturally due to the fact that Group 1 actually had to think of how the set of pieces could be assembled to form a certain figure, whereas Group 2 just had to copy the ‘assemblings’ drawn on their sheets. More precisely, for Sheet 1, Group 1 performed 4 times better than Group 2 (excluding the performance times of the participant from Group 1 who did not terminate the experiment); and for Sheet 2, Group 1 performed 4.2 times better than Group 2. This proves that the level of complexity of each sheet was approximately equal. Within each group, results were fairly similar in that, generally, for each sheet, a similar set of figures was considered difficult and another similar one was considered easier (see Appendices A and B).

In Sheet 1, Group 1 found Figures 4 and 8 easier and Figures 6 and 7 harder; Group 2 found Figures 3, 4 and 5 easier and Figures 6 and 8 harder. So, Figure 4 was found by both groups to be easier and Figure 6 was found by both groups to be harder.

In Sheet 2, Group 1 found Figures 3, 6 and 9 easier and Figures 2, 5 and 7 harder; Group 2 found Figures 3 and 9 harder and Figures 4, 5 and 7 harder. So, Figures 3 and 9 were found by both groups to be easier and Figures 5 and 7 were found by both groups to be harder.

3.2.3 Discussion & Relevance to the Project

It must be noted that the data collected just shows certain trends, it is not very precise, as each participant in Group 1 was given a variable number of hints (despite my trying to be fair in the number of hints given to each participant), to help them construct the figures on their sheets. For example, if the construction was nearly done except for one or two pieces but the participant wanted to destroy the whole construction and start again, I would let him know that the construction was perfect so far and to just try placing the remaining piece(s). Alternately, if a participant was trying to place a particular piece but could not determine its correct orientation and was therefore about to abandon the piece and try with another one, I sometimes advised him to continue trying with the former one. Yet, despite this variable amount of help offered to each participant, results do demonstrate clear patterns. The task assigned to Group 1 (without inner lines) was constantly considered more difficult than that assigned to Group 2 (with inner lines). This was the case whether the native language of the participant was English or German, which was quite predictable.

It must be noted however that one German native speaker from Group 2
did complain though about the colours of the shapes being printed in letters (in English) on the corresponding shape, as can be seen in Figure 14 above, rather than the shape actually being coloured in. This, apparently, slowed him down in the process of reconstructing the shapes because he first had to translate the English colour word into German, before finding the piece. Nevertheless, from the results it would seem that, on the whole, the German native speakers performed better, but it would be unfair to draw a conclusion from so little experimental data. Moreover, whether the participants were given the inner lines or just the outline, they still generally seemed to find the same figures difficult or easy, and, once again, the native language of the participant seemed to play no significant role in the judgment of the degree of difficulty of the various figures. Performance within the group with the inner lines and the outline was not significantly different for each figure; however participants who were given just the outline of the figures generally found less ‘compact’ figures, where certain shapes could be clearly identified, easier. Furthermore, individual differences must be taken into account when analysing results of such experiments, as some people are distinctly better at tangram building tasks than others; this explains why one participant constructed only six Tangram figures in the space of 80 minutes, whereas others constructed nine in the space of 22 minutes.

However, on the whole, this pre-experiment fulfilled its purpose. The aim of the task was to test the robustness of my judgments as to which of the tangram figures were difficult to construct and which ones were easy, so as to be able to predict certain ‘trends’ for the real experiment which is to follow. Thanks to the pre-experiment, I now know which tangram figures I should expect to cause difficulties, and which ones should be less problematic.

3.3 Pre-experiment 2

Goal: anticipate problems and results for the ultimate experiment

3.3.1 Setup

The second pre-experiment was carried out in January 2005. It involved two participants: one 21-year old English native speaker who had been learning French for eight years, and one 24-year old French native speaker who had been learning English for 12 years. They were sitting in two different rooms, but knew who they were talking to. They communicated using the online messenger service MSN provided by Microsoft, which will be described at greater length in Section 4.3.2. When using this software, a conversation window appears on each participant’s screen (see Figure 23, page 64). In
this window, they can see what has previously been said in the conversation, and by whom, and they can contribute to the conversation by typing in the bottom half of the window and then clicking ‘Send’. Speaker 2 will only see what Speaker 1 typed once Speaker 1 has clicked on ‘Send’. Before that, speaker 2 will simply see a message in the lower part of his conversation window saying “Speaker 1 is typing a message.”

Each participant had a sheet with nine Tangram figures, in random order, as well as a set of Tangram construction pieces (just the seven necessary pieces, no extra piece). In the first part of the experiment, the French native speaker (Speaker F), referred to as the ‘instructor’ in this situation, had to give instructions to the English native speaker (Speaker E), referred to here as the ‘constructor’, through English, in order for Speaker E to be able to reconstruct the figures on Speaker F’s sheet (see Appendix C, Sheet 2, page 144), using the construction pieces he was equipped with. Then, in the second part of the experiment, the roles were switched. The ‘instructor’ became the English native speaker (Speaker E), who thus had to give instructions to the French native speaker (Speaker F), now the ‘constructor’, through French, in order for Speaker F to be able to reconstruct the figures on Speaker E’s sheet (see Appendix C, Sheet 1, page 145), using the construction pieces he was equipped with. Originally, each speaker was supposed to get through the nine figures on the sheet. However, due to lack of time, Speaker F (the French native speaker) only managed to describe four figures in the first part of the experiment, and in the second part, Speaker E (the English native speaker) only managed to describe three figures on his sheet. The whole task lasted approximately two hours. The participants could communicate freely, asking for more information or confirmation if required, as long as it was all through English in the first part, and then all through French in the second part. Once they thought they had finished one round, I checked the constructed figure and if it was correct, they could move on to the next one; if not, I notified both the instructor and the constructor with regards to which shape(s) was (were) misplaced in the constructor’s construction. Then, the instructor would restate instructions concerning this (or these) shape(s), and this process was repeated until the construction was perfect. The construction of each figure was timed using a stopwatch.
3.3.2 Results

- First part of the experiment (French native speaker is the instructor, English native speaker is the constructor)

Figure 15: First Figure of Sheet 2

Figure 16: Second Figure of Sheet 2

<table>
<thead>
<tr>
<th>Figure</th>
<th>Construction Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Second</td>
<td>12 minutes</td>
</tr>
<tr>
<td>Third</td>
<td>28 minutes</td>
</tr>
<tr>
<td>Fourth</td>
<td>12 minutes</td>
</tr>
</tbody>
</table>

Table 1: Performance Times: Part 1, Pre-Experiment 1

The first thing to notice from Table 1 is that, apart from the third figure (see Figure 17), which caused a lot of problems possibly because its constituting shapes did not all touch whereas the constructor assumed that
Figure 17: Third Figure of Sheet 2

Figure 18: Fourth Figure of Sheet 2
they would, there seemed to be an improvement in the construction times as the experiment went on. Moreover, the data revealed that certain patterns clearly emerged in the speakers’ conversation. Speaker F (the ‘instructor’) always started by trying to give a figural description of the general aspect of the figure, if possible (such as an object, an animal, a person, a geometric shape), as can be seen in the following three extracts in (1).

(1) a. (see Figure 15)
   Speaker F says: The first figure should look like a house.
   Speaker E says: Ok

b. (see Figure 16)
   Speaker F says: Right! The second figure is a square. [sic]
   Speaker E says: Ok

c. (see Figure 17)
   Speaker F says: Shape number three: it’s really strange, so just follow the instructions

d. (see Figure 18)
   Speaker F says: Shape 4: It should look like a candle.

Throughout the construction process, if ever figural shapes emerged, that is, if ever a certain assembling of particular pieces yielded a shape which could be given a geometrical name such as “square” or a ‘real-world’ name such as “house”, they were given such names, as in (2). Such a description scheme is referred to as a ‘figural description scheme’.

(2) (see Figure 15)
   Speaker F says: Then, the yellow triangle and the green triangle go under the roof. The two of them make a square: the green one on the left-hand side and the yellow one on the right.

Also, if Speaker F used a figural description which Speaker E felt could be improved on, he would do so, as in (3).

(3) (see Figure 17)
   [Speaker F refers to a square as a “star”]
   Speaker F says: Right. Pay attention to the blue triangle  [mimetype: should have been ‘blue square’] : it should look like a star. Then, set the small blue triangle on top of the blue square, the longest side on the right (it does not touch the top of the square
   [Speaker E changes this to the more accurate “diamond”:
   Speaker E says: i have the blue square which looks like a diamond and the blue triangle to the right with the longest side to the right
[Speaker F adopts this term:] Speaker F says: The blue square should look like a diamond, so that’s great. Just move the blue triangle a bit upper, closer to the top of the square.

Moreover, after having tried to give the general aspect of the figure, Speaker F then usually started with the bottom-most shape (occasionally with the top-most), working his way then upwards (or downwards respectively), as in (4), which reflects Figure 18 above.

(4) Speaker F says: start with the pink triangle, longest side at the bottom: that’ll be the bottom of the candle.

Occasionally, Speaker F attempted to introduce an abbreviation, as in (5); however if this was not taken up by Speaker E, it was abandoned by Speaker F too.

(5) [Speaker F tries to abbreviate “parallelogram” to “par”:] Speaker F says: The par. goes above the top of the green triangle, small sides leaning on the right, longest sides parallel to the longest sides of the triangles(...)
Speaker E says: just finally tell me where the parallelogram is in relation to the diamond.

This apparent lack of convergence on the abbreviation “par” for “parallelogram” would appear to support the autonomous view of coordination described in section 2.4 of Chapter 2: the two speakers seem to not be receptive to one another’s expressions. This perhaps suggests that if the two speakers do not explicitly ground an expression (explicitly negotiate the meaning and use of each expression), then it does not enter the common ground and yields this lack of convergence.

Furthermore, every time Speaker F gave a construction instruction, if it was perfectly understood by Speaker E, he would confirm, generally using “ok”, as in (6):

(6) Speaker F says: add the blue square on top of it: on [sic] side touching the green triangle, the other the blue one.
Speaker E says: ok
Speaker F says: then, add the pink triangle on top of the blue square, the longest side not touching any other shape yet.
Speaker E says: ok

If Speaker E was not quite sure he had understood the instruction perfectly, he either asked for more information (7a), or asked a question to get
more details (7b) or tried clarifying the instruction (7c) or showed a sign of uncertainty (7d).

(7)  
   a. ask for more information:  
      Speaker F says: (...) we will make a stripe with various shapes  
      Speaker E says: ok with what other shape?  
   b. ask an explicit question requesting more details  
      Speaker F says: Start with the pink triangle: it is the roof  
      Speaker E says: Can u give me more details?  
   c. attempt to clarify an instruction  
      Speaker E says: when u say stripe, do you mean diagonal?  
   d. demonstrate a sign of uncertainty  
      Speaker F says: One of the sides of the triangle should be parreleel [sic] to the yellow triangle(...)  
      Speaker E says: ok, I think

Occasionally, if Speaker E was uncertain about the positioning of a few pieces, he went through the whole construction process so far, checking that everything was correct, as in (8), which relates to Figure 17 above.

(8) Speaker E says: ok, so, there are 3 triangles - green, yello [sic], pink on the bottom then on to of the green triangle is the yellow parallelogram.² beside that is the blue square and that blue square is between the two triangles?  
    Speaker E says: that right [sic]?
    Speaker E says: and none of these shapes are touching eachother [sic]
    Speaker F says: Right.

Mistypes and misuse of words occurred throughout the experiment. Here are two examples which again relate to Figure 17 above. In certain cases, they created confusion and possibly delayed the whole construction process (9a); in others, they did not disturb the other speaker (9b). Usually, the speaker who made the mistake realises it, but sometimes quite late.

(9) a. Example of a mistype which caused confusion:  
    Speaker E says: are the sides of the parallelogram leaning to the right or the left?  
    Speaker F says: to the right [but actually means ‘left’!]  
    [At a later stage in the conversation:]  
    Speaker F says: for the parallelogram: it is to the left of the diamond, small sides leaning to the left (i think i took the right for

²Note that the use of the word “parallelogram” by Speaker E is not a further instance of non-coordination, as it occurs before Speaker F trying to introduce the abbreviated “par” convention.
Admittedly, this is an issue of perspective, what the terms “right” and “left” refer to. However, since the start of the task, they seemed to have agreed on what perspective was to be taken when interpreting these terms.

b. **Example of a mistype which did not cause confusion:**

Speaker F says: then take the blue square: it goes between the green and the yellow triangles, but it should be much closer to the yellow one than to the green one (though it does not touch [sic] it)

Speaker F says: One of the sides of the triangle should be parallel [sic] to the yellow triangle

Speaker F says: I meant ‘touch’ and ‘parallel’ [sic] sorry...

Moreover, there was an ongoing problem with how to describe the colour of one particular triangle: the one with the beige, pale pink colour, as in (10), which relates to Figure 15 above.

(10) Speaker F says: Start with the pink triangle: it is the roof

[a few minutes later]

Speaker F says: Sorry: I was talking about the pale, pinkish triangle

[three figures later:]

Speaker E says: just confused about the really light coloured triangle

(...)

At the start of the experiment there was also a problem on Speaker F’s side concerning the parallelogram, because he did not know the exact term for such a shape. However, Speaker E knew it and Speaker F then adopted it, as in (11), which also relates to Figure 15.

(11) Speaker F says: (...) Then, you just need to add the yellow shape, one of the small sides touching the small blue triangle and one of the biggest sides touching the roof

[a few minutes later - Speaker E still has not used the word ‘parallelogram’ in his ‘speech’:

Speaker F says: the blue square, the pink triangle and the yellow rectangle

[a few lines later, Speaker E finally uses the correct word:]

Speaker E says: does the parallelogram go beside the pink triangle next?
[the next time Speaker F mentions the shape, the correct term has been adopted:]

Speaker F says: the yellow parallelogram goes on top of the green triangle [sic] (*horizontal)

So, without explicitly agreeing on the fact that the parallelogram shape should be referred to using its technical name “parallelogram”, by the end of the conversation both speakers seem to have coordinated on its use.

Finally, at the end of the description of one figure, if there were only one or two more shapes to be placed, and if the general aspect had been correctly given at the start, then the positioning of the last few shapes was usually guessed, as in (12), reflecting Figure 16 above.

(12) Speaker E says: ok
Speaker E says: i think i have the rest
Speaker E says: does the parallelogram go beside the pink triangle next?
Speaker F says: really? i must be great at giving instructions!!
Speaker E says: then the other triangle on the bottom

• Second part of the experiment (English native speaker is the ‘instructor’, French native speaker is the ‘constructor’)

<table>
<thead>
<tr>
<th>Figure</th>
<th>Construction Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8 minutes</td>
</tr>
<tr>
<td>2</td>
<td>8 minutes 30</td>
</tr>
<tr>
<td>3</td>
<td>9 minutes</td>
</tr>
</tbody>
</table>

Table 2: Performance Times: Part 2, Pre-Experiment 1

Many similar patterns to the English conversation emerged, despite the language change and the role switch. As the conversation was all through French, I tended not to quote many excerpts from the data, and limited myself to simply describing what I noticed.

Firstly, it must be noticed from Table 2 that the construction times were clearly inferior to those in the previous part of the experiment, proving an improvement in the task on behalf of the participants. When observing the data, it emerged that, as in the first part of the experiment, if an instruction was correctly understood, this was confirmed by an expression such as “ok”. If there was a doubt, further details were usually asked for or a question was
asked for confirmation. However, in certain cases, the constructor simply said “ok”, although he actually had not understood the instruction correctly (for further discussion of this, see Section 6.5, page 121). Also, in a few cases, if the instructor felt he had not been quite clear in his instruction, he either restated it or asked a question to check it had been understood, although in some cases this check or restatement was useless and just a waste of time. Similarly to the first part, at the start (see Example (1)) and within the dialogue (see Example (2)), if the instructor noticed that either the figure as a whole or parts of the figure had an aspect which could be described using a term from everyday vocabulary, he would make use of this figural description scheme, by communicating the aspect in question to the constructor. Actually if the initial general description was not given by the instructor, it was later requested by the constructor. Moreover, certain problems such as the pink/beige confusion remained. Furthermore, the first piece of each figure to be mentioned was always the bottom-most one. Then the instructor worked his way progressively upwards, each time describing the next adjacent piece.

Certain new features arose, mainly due to the French level of the English native speaker being lower than the English level of the French native speaker. I evaluated this by comparing their number of language mistakes as well as the extent of their respective vocabularies and use of idiomatic language. In some cases, Speaker E auto-corrected himself, without any interference of Speaker F (13a). In other cases, Speaker E corrected a certain formulation in his use of language after Speaker F using it correctly (13b). However, in yet other cases, Speaker E never corrected himself, despite Speaker F using the expression correctly (13c).

(13) a. auto-correction with no external interference

[Speaker E uses the incorrect form “le triangle en bleu”:]
Speaker E says: il touche le triangle en bleu
Speaker F says: a [sic] gauche de quoi?
Speaker E says: pardon, le plus grand cote du triangle jaune touche le triangle bleu
Speaker E suddenly corrects the incorrect form to “le triangle bleu” (no preposition between the noun and the adjective), without Speaker F even using this correct form.
b. auto-correction thanks to external sources

[Speaker F uses the correct form “cote”:]
Speaker F says: le plus grand cote en bas?

[Speaker E does not coordinate and uses the term “face” instead:]
Speaker E says: avec le plus grand face a droit [sic]

[A few lines later, Speaker E still uses the incorrect term “face”:]
Speaker E says: le plus grand [sic] face est vertical

[A few lines later, Speaker E finally starts using the correct form “cote”:]
Speaker E says: le plus grand cote est a gauche

c. no auto-correction

[At the start of the description of Figure 1, Speaker E uses the incorrect form “au fond” instead of “en bas” to mean ‘at the bottom’:]
Speaker E says: c’est au fond

[Speaker F uses the correct form “en bas” in his reply:]
Speaker F says: le plus grand cote en bas?

[At the start of the description of Figure 2, Speaker E uses the incorrect form “au fond” once again:]
Speaker E says: on commence avec le triangle vert
Speaker F says: ok
Speaker E says: c’est au fond
Speaker E says: a gauce [sic]
Speaker F says: le plus grand cote en bas j’imagine, non?

The error occurs again at the start of the description of Figure 3. There seems to be no convergence on a common form for this expression; however both speakers understand each other perfectly.

Lastly, as can be seen in Table 3, if there were similarities in the positioning of two shapes within one figure, Speaker E took a short cut by stating that the positioning of one shape was the same as that of the other shape (see Figure 1, Sheet 1, Appendix C, page 145).
### Data (verbatim) Translation

<table>
<thead>
<tr>
<th>Data (verbatim)</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaker E says: prends le grande [sic] triangle rose</td>
<td>take the big pink triangle</td>
</tr>
<tr>
<td>Speaker F says: c’est fait</td>
<td>done</td>
</tr>
<tr>
<td>Speaker E says: c [sic] comme le bleu</td>
<td>it’s like the blue one</td>
</tr>
<tr>
<td>Speaker F says: ok</td>
<td>ok</td>
</tr>
</tbody>
</table>

Table 3: Translated Data

#### 3.3.3 Discussion & Relevance to the Project

In this section, I shall briefly discuss the main results that emerged from the data of the second pre-experiment. As the design was so similar to that of the real experiment, and therefore the results also quite similar, I shall not go into too much depth here.

As stated previously, there was a general tendency in both parts of the experiment for the instructor to give the constructor a figural description at the start of each round, so that the constructor knew the general aspect of the figure he was building. Also, throughout the dialogue of any particular round, the instructor gave partial figural descriptions if possible. The purpose of such description seemed to be to make sure that everything was correct so far, and to have an easy reference point for the rest of the description.

Moreover, as mentioned previously, speakers tried to introduce their expressions into the conversation and then establish them as conventions. So, for example, in part 1, Speaker F tries to introduce the notion of cardinal points in his descriptions by using the formulation “the longest part [of the triangle] should look north”. In some cases, this grounding failed because the conversant did not adopt the expression in his language. Then, the speaker who tried to introduce the convention typically abandoned it. (This is the case in Example (5) when Speaker F tries to abbreviate “parallelogram” to “par” but Speaker E does not adopt this abbreviation and continues using the complete term “parallelogram”. Speaker F will then also continue using the full version of the word.)

However, in other cases, the conversant did adopt the expressions, thereby adding them to the ‘common ground’ between the two speakers. So, for example, in the first part of the experiment, both speakers came to an agreement concerning the meaning of the expression “the longest side [of a triangle] at the bottom”, which involved the triangle being positioned such that the right angle was pointing north and the longest side was completely horizontal and under the peak, such as depicted in Figure 19. The referring expression was
turned into a convention which was used many times throughout the conver-
sation in English, without ever creating any confusion. In this part of the
experiment, both speakers clearly agree on the fact that each triangle had
one longest side, and it could be at the bottom, at the top, to the left or to
the right. However, in the second part of the experiment, where the dialogue
is through French, confusion occurred. Speaker E used the French transla-
tion of the form they had converged on in the English dialogue, namely “the
longest side of the triangle at the bottom/at the top/to the left/to the right”,
but with a slightly different meaning. For him, the longest side was now con-
sidered to be at the bottom as long as it was neither looking up (with the
right angle pointing south) nor completely vertical with the right angle look-
ing to either side, such as the triangles pictured in Figure 20. This created
confusion for Speaker F who did not realise that Speaker E has assigned a
different meaning to the expression, and therefore tended to misplace certain
triangles.

![Figure 19: First part interpretation of a triangle with its “longest side at the bottom”](image1)

![Figure 20: Second part interpretation of triangles with their “longest side[s] at the bottom”](image2)

But in most cases, when a convention was adopted, it did not create
any further confusion, whether its instances occurred in the language it was
‘conventionalised’ in or in the other language, as long as the translation was
approximately literal. For instance, in Example (11) at the start of the exper-
iment, Speaker F did not know the exact term for “parallelogram”. Speaker
E knew it and helped him out; Speaker F then adopted the term “parallelogram”, which thereby became grounded and was turned into a convention. Whether in the French conversation or in the English conversation, any occurrence of the word “parallelogramme” or “parallelogram” respectively was perfectly understood and did not create any confusion or misunderstandings. A further instance of this convergence on terms and expressions is also reflected in the fact that if a speaker made a language mistake in his ‘speech’ and the correct form of this expression was then employed by the other speaker, the former speaker tended to adopt the corrected version in his mental lexicon and use it from them on. This occurred mainly in the second part of the experiment, due to Speaker E’s inferior level of French. Generally, towards the end of the description of one figure, if there were only one or two more shapes to be placed, and most importantly if the general aspect had been correctly given, then the constructor attempted to guess the positioning of the last few shapes, as in Example (12). This might explain why, in the first part of the experiment, Figure 3 took longer to construct than the others; no general aspect had been given at the start, therefore Speaker E could not guess the positioning of the last few pieces until they had been explicitly instructed by Speaker F. Finally, it must be reminded, that, at the end of the description of each figure, I checked whether the constructed figure was correct. If not, I informed both participants about which piece(s) was (were) wrong. This explains the revisions at the end of the individual descriptions, and also maybe the construction times which were quite long. Each description only came to an end once the exact Tangram figure had been reconstructed. Also, the fact that I knew how the figures were to be constructed, and could see how the constructor proceeded, enabled me to notice when an instruction was correctly understood, and when it led to confusion. Reading through the conversation, I could then find out the source of this confusion.

The aim of this second pre-experiment was to see what sort of results I should expect from the real experiment as far as language coordination and convergence on referring expressions were concerned. I set out to see if the aforementioned took place, and if so, in which situations, and how long it took for formulations to be grounded and conventions to be installed. I also wanted to make a first attempt using only two participants so as to see what sort of problems may occur, before heading blindly into my ‘real’ experiment. The time factor was also important: I wanted to see how long pairs needed approximately to achieve the construction of one figure, so that I could estimate how many figures pairs could realistically construct within a set time-limit. A further purpose of this pre-experiment was to reconfirm my intuitions about which figures were harder to instruct and construct, and
which ones were easier; this had already been pointed out by the first pre-
experiment. Moreover, I was curious to see how easy or difficult the tasks
of instructing and constructing in general were, and how good the average
performance was. Lastly, I wished to rate the necessity of my commenting
on the final construction at the end of each round, whether this helped or
confused and to what extent it delayed the onset of the next round.

3.4 Conclusion

These two pre-experiments were clearly very different, yet they both played
an important role in helping me design the ‘real’ experiment.

The first pre-experiment, described in Section 3.2, confirmed my intu-
itions about which figures were hard to construct and which ones were easy,
as well as whether or not the two sheets of figures, which I later used in the
‘real’ experiment, were of equal complexity.

The second pre-experiment, described in 3.3, gave me an insight into
what was to result from the ‘real’ experiment, as the same experimental task
was used. It demonstrated that linguistic coordination does happen to a
certain extent. However, it also proved that the task on a whole was not as
straightforward as I thought it was going to be. The rounds lasted longer than
I thought they would, mainly due to the occurrence of misunderstandings,
leading to confusion between the speakers.

In accordance with these observations, I designed the ultimate experi-
ment, which was to show what type and to what extent linguistic coordina-
tion occurred between German and English native speakers carrying out the
‘Tangram task’.
4 Experimental Design

4.1 Introduction

The aim of the experiment is to investigate linguistic coordination in a multi-lingual environment. I started by carrying out two pre-experiments which I described in the previous chapter. Moreover, the literature describes certain experiments carried out to investigate linguistic coordination, mainly in a mono-lingual environment. So, drawing from both these sources, I was guided in the design of my final experiment.

As was often the case in the experiments reviewed in the literature, I set up two experimental conditions: the ‘monogamous pairs’ condition (Section 4.2) and the ‘round robin’ condition (Section 4.3), so as to see whether the extent and the intensity of the coordination depended on the conversational situation. Sixteen participants in total took part in the experiment, half of them German native speakers learning English and the other half English native speakers learning German. The experiment took place in three sessions, each one lasting approximately two hours.

4.2 The ‘monogamous pairs’ situation

4.2.1 Participants

Eight participants were involved in this part of the experiment: four German native speakers and four English native speakers. They were all students in Trinity College, Dublin, and aged between 22 and 28 years old. The four German native speakers were all exchange students in Ireland, and therefore had a good level of both written and spoken English. The four English native speakers had all undergone formal instruction of German and had also spent a certain length of time in a German speaking country, thus making their level of German comparable to the other participants’ level of English. In this condition, for each monogamous pair, the German native speakers will be referred to as Speaker G, and the English native speaker as Speaker E.

This ‘monogamous pairs’ part of the experiment took place on two separate days. This was so that I could test the software and the lay out of the experiment, without running the risk of losing too much data if computers failed. Furthermore, as this part of the experiment only involved monogamous pairs, it did not make a difference whether all pairs were performing simultaneously or not. Each session involved four participants: two German

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3In the following description and discussion of the experiment, I have referred to all the participants with the generic masculine form “he”.
native speakers and two English native speakers. Both sessions took place in two adjacent rooms. The English native speakers sat in one room, the German native speakers in the other. Therefore, the English native speakers could see one another, and so could the German native speakers, but the two groups could not see each other. Moreover, they did not know who the members of the other group were but knew that they were native speakers of the ‘other’ language.

Furthermore, the participants took part on a voluntary basis.

4.2.2 Software Used

I needed a program which would permit participants to converse using a computer, so that, at the end of the experiment, I would have a written transcript of the whole conversation. For the first part of the experiment involving the monogamous pairs, I decided to use a shared (or collaborative text) editor, in process of being developed by a research student in the Computer Science Department at Trinity College, Dublin. The original purpose of the editor is to allow multiple people to write a paper together over the computer, but I made use of it as a chat interface. Up to six participants may be involved in the one conversation, and each one is assigned a particular colour. On the screen in front of each participant involved, a window appears in which they can see all the text written so far, as well as the names and the colours of the other participants in the conversation. They can also type in this window. A screenshot can be seen in Figure 21. Moreover the conversation window is sectioned in paragraphs, so each new line is annotated with a paragraph number (such as p1 or p2). This is to permit two different participants to be working on two different paragraphs of the paper at the same time. When one speaker is typing, all the other participants can see in real time what is being typed and by whom, thanks to the colour of the text. However, the typist retains a lock on the paragraph he is currently typing in, so while he is typing no one can amend or delete his text, or type into the same paragraph. They may however be typing simultaneously in a previous or following paragraph. This lock is retained for approximately two seconds after the typist has stopped typing. Once this time elapses, the typed text becomes black again, which indicates to the other participants that a lock on the paragraph is no longer retained and someone else can start typing there.

One big advantage of this program for me was the very detailed log which it yields. While the program only runs on a certain number of computers corresponding to the number of participants, referred to as the ‘clients’, there must also be a computer in the background on which the ‘server’ is running. All conversing computers are connected to this server, through the input of
Figure 21: Sample screenshot of the shared editor
IP addresses. The server displays the full conversation in real time. At the end of the dialogue, the final version can be saved as a .xml file. When opened in a browser, this file is divided into two sections. The first section details the exact happenings for each paragraph in the conversation. Each ‘typing action’ is referenced by a number and each participant is assigned a number. This section details which ‘typing actions’ occurred within each paragraph: an ‘insert action’ or a ‘delete action’, between which specific timestamps it took place, and who performed it. It also displays for each paragraph the final version of the text. Then, in the second part, all the typing actions are listed in ascending order of their reference numbers. For each action, the ‘ID’ number is given, the paragraph number in which it occurred and the text which was either added or deleted. To find out, who carried out the action and whether it was an insert or a delete action, one must refer to the first section of the log record.

However, many problems did arise with this piece of software. In many cases, one subject could no longer see anything that his conversation partner was typing. Also, the client windows tended to freeze quite often, so that users could no longer type in their messages. This meant that the clients had to be loaded again. In certain cases, this worked fine, as the participant identities’ who were involved in the ‘frozen conversation’ were deleted, however in other cases, these participant ID’s were still counted as being part of the conversation though they could not actively take part in it. The problem was that, as the number of participants in any conversation is limited to six by the software, this rapidly led to a participant overflow. Then, the whole server had to be rebooted, and a recording of data up to that point was made so as to not lose the data collected so far. Moreover, the server itself sometimes froze. In this situation, the conversation text was not lost, but it was impossible to get a .xml file out of it, and therefore no detailed log of it could be obtained. So, one could simply see the final version of the text, not the amendments which had been made throughout the conversation, nor the exact timestamps of each action. This was not too bothersome for the later analysis of the data; however having to regularly interrupt the task so as to restart servers and clients clearly destabilised the participants and affected their performance. In certain cases, the participants lost approximately three minutes in a round limited to ten minutes. I am not sure what these technical failures were due to - possibly to the fact that the software was still in process of being developed and it was originally designed as a shared editor, not a chat interface, so the intensity and the speed of the interaction may have been too much for it to cope with. Since my use of the program, a new version has been released. However to expedite progress, I decided against using it.
4 EXPERIMENTAL DESIGN

4.2.3 The Task

Participants were paired together, one German native speaker with one English native speaker. They both had their own computer on which a conversation window was open. In this window they could perceive (without seeing) the presence of the other participant, as well as the whole conversation so far. Each participant did not know that they were in a monogamous pair situation. They were only told that they were speaking to a native speaker of the other language in each round, but it was not specified to them whether it was the same one throughout the experiment or not.

Each participant was given a sheet with guidelines for the experiment, and a section at the bottom where they had to declare their agreement to their conversations being recorded and analyzed (see Appendix G, page 159). Moreover, they were equipped with a set of seven construction pieces and a sheet with six tangram figures on it (a condensed version of the sheets used in the pre-experiments), as can be seen in Appendix E, on page 156. As in the second pre-experiment, each pair member was assigned a role at the start of each round: either ‘constructor’ or ‘instructor’. An instructor had to give instructions about the construction of a certain tangram figure which was pictured on his sheet, by typing them into the conversation window open in front of him. The colours of the pieces drawn on his sheet matched the colours of the construction pieces which the constructor was equipped with. A constructor therefore had to read and carry out the instructions he was given, and, using the set of shapes he was equipped with, had to try and reconstruct the figure which was pictured on the instructor’s sheet. To further complicate the task, the instructor always had to instruct in his foreign language (either German or English), and this set the communication language for the whole round. The constructor was allowed to interact as much as necessary with the instructor so as to achieve the task, as long as this interaction took place in the instructor’s foreign language. At the end of each round, the roles were switched. The former instructor became constructor and the former constructor became instructor and had to describe a figure on the sheet he was provided with, which was naturally different from the sheet the conversation partner had. The colours of the pieces on his sheet matched the colours of the pieces that the new constructor was equipped with. Furthermore, each sheet was designed such that it contained two easy figures, two medium figures and two hard figures. Thanks to the first pre-experiment which I carried out, I could establish which figures were hard and which ones were easy to construct and therefore design two sheets of equal complexity.

Originally, each pair was supposed to switch roles once the constructor
thought he had achieved his construction, and in this way, each pair was supposed to ‘play’ twelve rounds, so that each participant would be instructor six times and constructor six times. As I no longer told the participants at the end of the round whether the construction was correct or not, but just left them decide themselves whether they thought they were finished or not, I thought the rounds would be considerably shortened. However, the pairs were not as quick as I expected at the task and many technical problems occurred, so I had to impose a time limit of approximately ten minutes for each round, from the second round onwards, and had to limit the number of rounds to six, so that each pair member instructed and constructed three times. I selected for each pair a set of three figures per sheet such that each participant had one easy one, one medium one and one hard one to instruct and construct. Once again, these judgments were based on the first pre-experiment. On Sheet 1, they were supposed to all do Figure 1 (medium), Figure 3 (easy) and Figure 5 (hard); however pair 1 had a computer problem during Figure 3 (easy) and the data was lost, so I had to take data from Figure 2 (medium), which they had also had time to do. On Sheet 2, they all did Figure 1 (easy) and Figure 5 (hard). Then, pairs 1 and 2 did Figure 2 (medium), and the two other pairs did Figure 3 (medium) (see Appendix E, page 156 for the sheets).

At the end of each round, I took a photograph of the construction, so as to be able to rate the completeness and the correctness of the construction (see Appendix F, page 158). At the end of the experiment, I asked each participant whether he felt any improvement in his instructing or constructing skills and whether he thought he had been talking to the same person all through the experiment, and if not, how many different people he felt he had talked to. I also asked each participant to rate the figures in order of difficulty to instruct, and then gladly accepted any further comments concerning the experiment (see Appendix H, page 161).

4.3 The ‘Round Robin’ (or ‘community group’) situation

4.3.1 Participants

Eight other participants were involved in this part of the experiment: four German native speakers and four English native speakers, none of which had previously taken part in any one of my experiments. They were all students in Dublin, and aged between 21 and 26 years old. The four German native speakers were all exchange students in Ireland, and therefore had a good level of both written and spoken English. The four English native speakers
had all undergone formal instruction of German and had also spent at least a year in a German speaking country, thus making their level of German comparable to the other participants’ level of English. Two of the German native speakers were Austrian, but as they were told to speak ‘Hochdeutsch’, this did not have any significant effect on the performance and the task in general.

The eight participants were seated in one computer lab. However, they were all quite spaced out so that, although they could see each other, they could not see what any other person was typing or constructing. Each participant was assigned a number and they were all under strict instructions to neither talk to each other orally, nor communicate their participant number to anyone. So, the participants were referred to as ‘Participant 1’, ‘Participant 2’... For clarity purposes, in this thesis I have assigned the letter ‘E’ or ‘G’ to each participant number to indicate whether the participant in question is an English or a German native speaker. Moreover, participants knew that the participants they were going to interact with were all native speakers of the ‘other’ language. Here also, the subjects participated on a voluntary basis.

4.3.2 Software Used

Due to the shared editor used not being very reliable, I decided to use a different piece of software for this experimental situation. I made use of the instant messenger service called ‘MSN Messenger Service’ provided by Microsoft. As its name indicates, this is an instant messenger service thanks to which people all over the world can ‘chat’ in real time. The program can either be downloaded on to the computer or an online version of it, requiring no downloading, may be accessed. I used the latter (http://webmessenger.msn.com).

To access the service, the user must have a hotmail address; if he does not, he must register and create one. Therefore, I created eight accounts, one for each participant. The account addresses followed the same pattern: ExpParticipant1@hotmail.com, ExpParticipant2@hotmail.com... Then once a user has accessed the service (by typing in username and password), a list is loaded on the screen with all the user’s ‘contacts’ (people whose hotmail address the user had previously added to his ‘contact list’) and whether they are currently online or offline (see Figure 22). Thus, for each account, I created contact lists, so that for any one participant, his contact list contained all the participants who he would be required to communicate with throughout the experiment. For example, when Participant 1E (an English native speaker) logged in to the service, he could see whether Participant 5G, Participant 6G, Participant 7G and Participant 8G (the four German native
speakers) were online or offline. Then, the user may click on the name of any contact who is online and a conversation window appears on the screen (see Figure 23). The conversation window is divided into two parts. In the upper one, each conversant can see a record of the conversation so far, each utterance being preceded by an annotation such as “Participant 1 said:” or “Participant 5 said:”. The lower part is simply an empty text box, in which the user can type freely, regardless of whether his conversation partner is also typing at that time or not. When the other speaker is typing, a line appears at the extreme bottom side of the window warning that “Participant x is typing a message”. Once the user has finished his message, he clicks on the ‘Send’ button, the message goes into the upper part of the screen preceded by the phrase “Participant x said:”, and the lower text box becomes empty again.

One drawback of this program is that a user can only see what his conversation partner has written once the latter has clicked on the ‘Send’ button instead of seeing in real time everything the conversation partner is typing or deleting. This means that participants are often left waiting for their conversation partner, who is currently typing a whole block of text, to click on the ‘Send’ button. Furthermore, in some cases, one user is typing a question, and at the same time his conversation partner is giving an instruction which answers the question; however, as both speakers do not see what the other is typing, they cannot anticipate this. If both participants then click on ‘Send’ simultaneously, the system has to give priority to one of them, so in certain cases, in the data, a question follows an instruction containing its answer. So, in certain cases, I had to reconstruct what I thought had been the sequence of dialogue, deciding, for instance, whether a certain utterance was an answer to a question asked by the conversation partner or rather an anticipation of this question. The slight inaccuracy and vagueness of the data is therefore clearly a further drawback of this program. There is no such thing as a .xml file with timestamps, or mention of what was typed but then deleted. At the end of the conversation, a simple copy and paste from the conversation window into a spreadsheet is done, and one can simply read the final version of the conversation. As mentioned previously, the sequence of utterances was also not always very exact, as the system had to make decisions if both conversation partners clicked on ‘Send’ simultaneously; and as timestamps of the start of the typing action and the end of the typing action are not recorded, it is impossible to see who actually started typing first. For the purpose of my experiment, this vagueness in the data was not too significant, and was clearly compensated by the lack of computer failures.

Indeed, the one main advantage of this program was its stability. Throughout the whole experiment, there was just one brief technical incident, which
Figure 22: Sample screenshot of Participant 5’s contact list on MSN
Figure 23: Sample screenshot of a conversation window on MSN
did not create any confusion or destabilisation. None of the conversations were ever interrupted and each speaker could always correspond perfectly (write to and read) with the conversation partner. Furthermore, no piece of data was lost. Also, the fact that most of the participants had already previously used this service for their personal use meant they were familiar with it and knew how to use it, which was obviously an advantage.

4.3.3 The Task

The main difference between this experimental situation and the preceding one was that participants were no longer put together in the same partnership fixed throughout all the rounds of the experiment. The pairings only lasted for the length of one round. Then they switched partners. However, all participants were members of a ‘closed community group’. Moreover, in each pairing, there was always one German native speaker and one English native speaker, one playing the role of ‘instructor’, the other that of ‘constructor’. They both had their own computer on which their contact list was loaded (see Figure 22). So each participant could identify the four German (or English respectively) participants that he was going to communicate with at some stage throughout the experiment. However, each participant was simply referred to with a number, so that each subject, despite being able to ‘see’ all the people in the room, did not know exactly to whom he was speaking in any particular round.

As in the previous part of the experiment, each participant was given a sheet with guidelines for the experiment, and a section with their agreement declaration (see Appendix J, page 184). Each participant also had a sheet on which the exact procedure of the experiment was detailed: for each round, who he was supposed to talk to, what his role was (either instructor or constructor), what language he had to communicate in and which figure he was to describe if he was an instructor (see Appendix K, page 186). Moreover, as in the previous part, they were equipped with a set of seven construction pieces and a sheet with six tangram figures on it (see Appendix E, page 156).

At the start of each round, they had to click on the number of the participant in their contact list who they were to communicate with according to their ‘procedure sheet’. Then a conversation window appeared (see Figure 23) and they could either start instructing or had to wait for instructions to start constructing, depending on their role (also indicated on the ‘procedure sheet’). The pairings were set up so that no same participant was involved in two conversations at the same time and so that within any pairing there was always one member who played the role of constructor and another who played that of instructor, depending on what role they had played in the
previous round. Incidentally, for organisational simplicity reasons, all the German native speakers were instructors (or constructors respectively) simultaneously, and similarly for the English native speakers. Each round lasted ten minutes, although in certain cases, pairs finished before the time was up. At the end of each round, I copied and pasted the conversation just terminated into a spreadsheet which I saved, so as to prevent losing too much data in case of a technical failure. Then each participant closed the conversation window on his screen, and, once the start signal had been given, by following the indications on his ‘procedure sheet’ for the next round, he clicked on the ‘correct’ contact (or participant) on his contact list, a new conversation window appeared and he took on his new role. Each participant was alternately instructor and constructor, as in the previous part of the experiment.

The figure sheets used were the same as in the previous part of the experiment so that each sheet contained two easy figures, two medium figures and two hard figures. However, because in the previous part of the experiment pairs had only had time to do six rounds altogether, I crossed out one easy, one medium and one hard figure from each sheet, so that each participant only had three figures to construct and instruct. These were roughly the same ones as the ones the participants in the ‘monogamous pairs’ condition had done, and once again my judgments of complexity were based on results from the first pre-experiment. On Sheet 1, they did Figures 3 (easy), 5 (hard) and 1 (medium) (or Figures 1, then 5, then 3, depending on the participant); and on Sheet 2, they did Figures 1 (easy), 5 (hard) and 3 (medium), in this order (see Appendix E, page 156).

As there were six rounds in the experiment but only four members in each group (four German native speakers and four English native speakers), and each German (or English respectively) native speaker could only communicate with an English (or German respectively) native speaker, each participant communicated with two participants twice and with two just one time. Thus, in rounds 5 and 6, they were talking to the same person and had the same role as they had had in rounds 1 and 2; just the figures were different. No same participant ever constructed or instructed the same figure twice.

Furthermore, as in the previous part of the experiment, at the end of each round I took a photograph of the construction, so as to be able to rate the completeness and the correctness of the construction (see Appendix F, page 158). At the end of the experiment, I also asked each participant to fill in a questionnaire about whether he felt any improvement in his instructing or constructing skills. They were also asked to rate the figures in order of difficulty to instruct, and were then invited to write down any further
comments concerning the experiment (see Appendix L, page 187).

4.4 Conclusion

With this experiment, I hope to explore the phenomenon of linguistic coordination in a multi-lingual environment, here consisting of German and English. Linguistic coordination refers to the convergence (or divergence) of conversation partners on features such as referring expressions, grammatical structures or pragmatic views in dialogue; to use technical terms, how much “grounding” takes place in a conversation between two speakers with different mother tongues, whereby one is communicating in his mother tongue, the other in his native language.

I used the results of my pre-experiments (Section 3) and information from the literature (Section 2) to set up a task involving sixteen participants in which tangram figures had to be constructed by pairs of participants: one member of the pair had to construct the figure thanks to instructions given by the other member, i.e. his conversation partner. Moreover, I set up two experimental conditions: one in which pairs were fixed throughout the whole experimental session (referred to as the ‘monogamous pairs’ condition) described in Section 4.2 and one in which pairs changed at the start of each round (referred to as the ‘round robin’ or ‘community group’ condition), described in Section 4.3. This enabled me to see whether the extent of the linguistic coordination depends on whether a speaker was always communicating with the same partner or switched partners at every round.

Lastly, as I mentioned on page 58, many technical problems did occur in the first part of the experiment, the ‘monogamous pairs’ condition; however by piecing together bits of conversation, I managed to almost entirely reconstruct the conversations.
5 Results and Analysis

5.1 Introduction

As described previously the task covered two different experimental conditions: the ‘monogamous pairs’ condition where pairs of participants were matched in pairings which stayed fixed throughout the whole experiment, and the ‘round robin’ (or ‘community group’) condition where the pairings changed at the start of each round, so that by the end of the experiment each participant of a certain ‘language group’ (the English native speakers or the German native speakers) had been matched at least once with each participant of the ‘other language group’. In either experimental condition, six rounds were ‘played’, meaning that each participant took on the role of constructor and the role of instructor three times each respectively.

I took photographs of the achieved construction at the end of each round (see Figure 24 for a sample), and I timed the duration of each round. Thus, I was able to rate the constructions for completeness and correctness (Section 5.2). Moreover, because the conversations took place over the computer, at the end of the experiment I got a written transcript of the whole dialogue, and for most of the dialogues from the first experimental condition, I also had the very detailed .xml file at hand. This allowed me to analyse coordination and convergence between speakers in each pair (Section 5.3). Lastly, at the end of each experimental session, I asked the participants questions about their performance, and their impressions about the experiment in general (Section 5.4).

5.2 Success of Task

The first and easiest level of analysis is to examine the success of the task, which is reflected through two criteria: the degree of correctness of the construction, which refers to how similar the construction is to the picture featured on the instructor’s sheet; and the degree of completeness, which refers to how many pieces had been placed in the construction at the end of the round (after approximately ten minutes), regardless of whether they were correctly placed or not. I rated these degrees on a scale from 1 to 5 where 1 is the worst and 5 the best. So, for example, if a constructor had only placed two pieces at the end of the ten minutes, but these two pieces were placed identically to how they featured on the instructor’s sheet, the degree of completeness would be very low (generally 1), but the degree of correctness would be 5.

The enclosed CD contains all the photographs taken (see Appendix F,
5.2.1 The Monogamous Pairs Condition

Four pairs of participants were involved in this first experimental condition. Two pairs took part in the first experimental session, the other two in the second session, which took place a week later.

The first pair achieved an average degree of completeness of 5, meaning that they always managed to finish the construction within the time limit imposed. It must be reminded though, that the two first pairs were at an advantage, as they took part in the first experimental session which, as afore-mentioned, had no time limit at all set for the first round. After that, the limit progressively got shorter with the rounds. Their average degree of correctness was 3.5: more specifically, it averaged 3 when one participant was instructing and 4 when the other was constructing. Surprisingly, it decreased with time: in the first two rounds, their degree of correctness was 5 whereas in the last round, it had gone down to 1. When interpreting these results, the technical failures, the increasingly shortened time limit and the figure complexity must be taken into account.

Figure 24: A sample photo
The second pair achieved a constant degree of completeness of 5 throughout the whole experiment, meaning that, by the end of the time limit in each round, each one of the seven pieces had been assigned a position in the construction, be it correct or not. Their average degree of correctness was also 3.5, like that achieved by the first pair. However, contrary to the first pair who were very irregular in their correctness degrees (ranging from 5 to 1), this pair was more regular, typically achieving degrees of 3 of 4. As in the previous pair, both participants were almost equally good in correctness and completeness.

The third pair had an average degree of completeness of 3.5. This degree was different depending on who was instructing and who was constructing (3 or 5 respectively). However, this pair was seriously disadvantaged by computer problems, meaning that in certain rounds, they were only actually able to communicate for about one minute out of the ten assigned to the round, thereby achieving very low degrees of completeness. On the other hand, their degree of correctness was 5, regardless of who was constructing or instructing. This degree was not affected by the computer problems, as it only measures whether the pieces which had been placed were effectively correctly positioned or not.

The fourth pair also achieved an average degree of completeness of 3.5, resulting from a degree of 3 when speaker G of the pair was constructing and one of 4 when speaker E was constructing. This pair was also affected by computer problems but to a lesser extent than the previous pair. Their average degree of correctness was 4, largely influenced by the last round in which they only achieved a correctness degree of 1. Here again, this average resulted from member A having an average degree of correctness of 3 when constructing, whereas member B had an average degree of 5 when constructing.

On a whole, the two last pairs who were involved in the second experimental session achieved lower degrees of completeness (average of 3.5) than those achieved by the two first pairs involved in the first experimental session (average of 4.5).

5.2.2 The Community Group (or Round Robin) Condition

This experimental condition involved eight participants: four German native speakers and four English native speakers who were matched together so that each pair contained one German native speaker and one English native speaker. However, contrary to the previous experimental condition, the pairings changed at the start of each round. As in the previous experimental condition, each participant played six rounds, thereby alternately acting
three times as constructor and three times as instructor.

I first calculated the degree of correctness and completeness (on a scale from 1 to 5 with 1 being the lowest and 5 the highest) for each pair in each round, and thus the average degree of correctness and completeness for each round. The degree of correctness seemed to decrease with time, starting off at 4 in the first round and then averaging around 3 in the last rounds. However, it must also be reminded that the figures got more difficult with time. On the other hand, the degree of completeness was very good throughout the rounds, increasing from an average of 4 in the first round to a constant level of 5 in the last two rounds. Then, I calculated for each participant their average degree of correctness and completeness when instructing and when constructing.

- The English Native Speakers

1. Participant 1E
   As an instructor, he achieved an average degree of correctness of 3 and an average degree of completeness of 5.
   As a constructor, he achieved an average degree of correctness of 2 and an average degree of completeness of 4.

2. Participant 2E
   As an instructor, he achieved an average degree of correctness of 4 and an average degree of completeness of 4.
   As a constructor, he achieved an average degree of correctness of 4 and an average degree of completeness of 5.

3. Participant 3E
   As an instructor, he achieved an average degree of correctness of 3.5 and an average degree of completeness of 3.5.
   As a constructor, he achieved an average degree of correctness of 3.5 and an average degree of completeness of 4.5.

4. Participant 4E
   As an instructor, he achieved an average degree of correctness of 3.5 and an average degree of completeness of 5.
   As a constructor, he achieved an average degree of correctness of 3 and an average degree of completeness of 5.
The German Native Speakers

1. Participant 5G
   As an instructor, he achieved an average degree of correctness of 3.5 and an average degree of completeness of 5.
   As a constructor, he achieved an average degree of correctness of 3 and an average degree of completeness of 4.5.

2. Participant 6G
   As an instructor, he achieved an average degree of correctness of 2 and an average degree of completeness of 5.
   As a constructor, he achieved an average degree of correctness of 3 and an average degree of completeness of 5.

3. Participant 7G
   As an instructor, he achieved an average degree of correctness of 4 and an average degree of completeness of 5.
   As a constructor, he achieved an average degree of correctness of 3 and an average degree of completeness of 4.

4. Participant 8G
   As an instructor, he achieved an average degree of correctness of 3 and an average degree of completeness of 3.5.
   As a constructor, he achieved an average degree of correctness of 5 and an average degree of completeness of 4.5.

So it seems that, on the whole, participants had time to instruct or place all or almost all of the seven pieces in each tangram figure. However, these pieces were often misplaced, as is reflected by the relatively low degrees of correctness.

5.2.3 Comparison of the two conditions

Regarding the degree of completeness, the pairs in the community group appear to have performed slightly better. The average in the community group condition is 4.5 whereas that in the monogamous pairs condition is 4. However this difference is minimal.

Regarding the degree of correctness, the difference between the two conditions also appears to be minimal, this time the pairs in the monogamous pairs condition performing slightly better than those in the community group.
condition: the average degree of correctness in the monogamous pairs condition is 4, with individual performances ranging between 3 and 5, whereas the average degree of correctness in the community group condition is 3.5, with individual performances ranging between 2 and 4.

5.3 Co-ordination and Convergence

After examining the correctness and completeness of the constructions, I analysed all the dialogues, noticing each attempt by either one of the speakers to introduce either a specific expression or a description technique, and also noted whether this was then adopted by the other speaker. Generally, it was more frequent for a participant to try introducing a new convention when instructing in a round, than when constructing in a round, because constructors often tended to simply read and carry out instructions received, without much interaction. For each pair member, I then counted the number of ‘chunks’ which the speaker employed in his own language but which had been previously introduced by the other pair member, thereby signaling co-ordination between their two ‘languages’. I also differentiated for each round the number of conventions adopted by a particular speaker for the first time, and those which he had already adopted in a previous round and was just reusing. Moreover, I calculated an average of the chunk lengths repeated by each speaker, but will not mention this figure, as it is rather inconclusive and does not indicate the actual extent of coordination. What follows is a comprehensive report of the extent of coordination and convergence for each participant both in the ‘monogamous pairs’ condition (Section 5.3.1) and in the ‘community group’ (Section 5.3.2).

5.3.1 The Monogamous Pairs Condition

• First Pair

Speaker G-German Native Speaker

*Instructed Figures 1, 2 and 5-Sheet 2; Constructed Figures 1, 2 and 5-Sheet 1 (see Appendix E, page 156)*

Speaker G hardly adopted any conventions when he was constructing, as he tended to simply confirm every instruction with utterances such as “ok”, “ja”, “gut”, thereby keeping interaction to a minimum.

However, as an instructor he demonstrated having adopted many expressions and description techniques introduced by Speaker E. Depending on the current language of the round they were introduced in, he either repeated
them literally or had to translate them into the language imposed by the
particular round. So, in Round 2, where Speaker G was instructor for the
first time, he ‘repeated’ six ‘conventions’ taken from Speaker E:

• a description scheme based on left, right, top and bottom
• giving a geometric figural description within the instruction process,
such as saying that the construction so far should look like one square
• giving a real-world figural description within the instruction process,
such as saying that a certain piece should be positioned like a roof
• using a ‘level’ description scheme with expressions such as “on top of”
• referring to the hypotenuse of a triangle as “the long basis”
• using the term “parallelogram”, though it is not clear whether the
  speaker already knew the word and would have introduced it himself,
  had the other speaker not done so first.

In Round 4, Speaker G used these expressions or description techniques
once again, and adopted one further one into his speech: using the word
“peak” to refer to the top right hand side of parallelogram.

Finally, in round 6, Speaker G still made use of the previously ‘copied’
conventions, and adopted three new ones from Speaker E’s utterances into
his language:

• “gets in contact with” to mean ‘touches’; literal translation of “in Kon-
takt mit” used by Speaker E
• “one of its shorter sides” with respect to a triangle
• using cardinal point descriptions for the orientation of the parallelo-
gram or the triangle, such as “pointing north-east”.

The .xml record of Speaker G’s utterances, which detailed all ‘delete’
and ‘typing’ actions, showed that he had great difficulty spelling words
such as “triangle”, at worst going through the whole sequence “trainal”,
“trainalg”, “traingl”, “tringle” before reaching the correct “triangle”. Also
words such as “finished” and “showed” were instinctively written “finisched”
and “schowed”, clearly under the influence of German spelling.
Speaker E—English Native Speaker

Instructed Figures 1, 2 and 5—Sheet 1; Constructed Figures 1, 2 and 5—Sheet 2 (see Appendix E, page 156)

Similarly, Speaker E hardly adopted any instructions when constructing: in the first two rounds as constructor, he tended to simply confirm understanding instructions with utterances such as “ok”. In the last round, he started asking more questions, so that if the instruction was not completely understood, he would ask for clarification: “so only the right tip of the white triangle touches the top left-hand corner of the blue square?” (Note that the conversation in the first round where Speaker E constructed contained 202 words, whereas that in the last round where Speaker E constructed contained 305 words.)

However, even in the instructing rounds, Speaker E tended to adopt much fewer of Speaker G’s expressions and description schemes, than Speaker G did of Speaker E’s expressions. In rounds 1 and 3, Speaker E did not effectively adopt any new conventions, he simply learned from the German native speaker’s language the correct gender or ending of German terms, which he had not known beforehand. Then in the last round as ‘instructor’, he demonstrated having adopted one new referring expression: “die obere spitze” for the right angle of a triangle (literal translation of Speaker G’s expression “the top peak”) and one new description technique, which consisted in giving the general aspect of the figure at the start of the round.

On the whole, Speaker E tended to introduce more new expressions and description techniques than Speaker G did, thereby adopting less of Speaker G’s ones.

General Remarks

In the fifth round of the experiment, a computer problem occurred, so I decided to not count it and added a seventh round onto the end of the experiment. Thus, Speaker G was instructor in rounds 2, 4 and 6 (rounds 4 and 6 being consecutive, as round 5 was eliminated) and Speaker E was instructor in rounds 1, 3 and 7.

Some expressions differed throughout the whole experiment; so, for example, Speaker G usually referred to the right angle of a triangle as the “90 degree angle”, whereas Speaker E usually referred to it as the “90Ecke” (=90Angle”). Moreover, in many cases, one of the speakers started typing a message in their foreign language making use of a particular grammatical construction, and then abandoned in the middle, erased everything and started again with some other simpler construction. Also, a speaker typically
wrote a message and then decided that the message should be made clearer, so either decided to add in words such as adjectives into his message, or decided to change a certain expression, usually opting for an expression which had formerly been used throughout the experiment and could therefore be assumed to be understood. Lastly, it emerged that towards the end of each round, when the time limit was approaching, the two speakers tended to behave in different ways. They both seemed to correct their spelling much less and pay less attention to what exactly they were typing. However, Speaker G seemed to feel pressurised by the lack of time and just urged to move on to the next instruction, whether the previous one had been fully understood or not; whereas Speaker E preferred to make sure that each instruction given was fully understood, thereby continuing to ask for further clarification right until the time limit had elapsed.

- **Second Pair**

Due to computer problems, the data of the third round was not recorded. Therefore, in the rounds which were recorded, both rounds 2 and 3 assign the same roles to the participants, and they only switch at the start of round 4. To compensate for this loss, an extra round was added on to the end, so that each participant did take on the ‘instructor’ role three times and the ‘constructor’ role three times.

**Speaker G-German Native Speaker**

*Instructed Figures 1, 2 and 5-Sheet 2; Constructed Figures 1, 3 and 5-Sheet 1 (see Appendix E, page 156)*

As a constructor, Speaker G tended not to simply say “ok” or “ja”, but rather ask questions to get more information about the placement of a certain piece. This tendency is especially visible in the first round. Then in the second and third rounds, Speaker E is constructing and he tends to often simply use “ok”, instead of ensuring understanding by asking questions, so in the fourth and sixth rounds, when Speaker G is once again the constructor, there are many more utterances such as “ok”, “hab ich” (=I have that), “ja, ist gut”, as if Speaker E’s ‘constructing attitude’ had had an influence on his. In Round 4, Speaker G made use of certain new conventions taken from Speaker E’s utterances:

- “die haelfte” (=the half) to refer to half of the long side of a triangle
- “nach rechts aussen” (=towards ‘right outside’) to refer to the orientation of the right angle of the triangle
• “halb so lang wie” (=half as long as) to compare lengths of sides of pieces.

Furthermore, in cases where Speaker G did ask questions, these had various formats: they either simply asked for more information, or aimed to check a piece was correctly placed by stating information not included in Speaker E’s instructions and seeing if this was also correct, or, in certain cases, Speaker G enumerated the possible answers in his question, so as to make answering for Speaker E easier.

As an instructor, Speaker G demonstrated having adopted a few of Speaker E’s utterances, especially in Round 3:

• “shape” instead of the word “form” which was previously used
• “long side facing to the right” or “long side facing downwards” to refer to the position of a triangle. This convention was introduced in the same round by Speaker E who asked: “with its long side facing inwards, you mean?”

On the whole, Speaker G tended to introduce lots of new conventions rather than adopt Speaker E’s ones.

Speaker E-English Native Speaker
Instructed Figures 1, 3 and 5-Sheet 1; Constructed Figures 1, 2 and 5-Sheet 2 (see Appendix E, page 156)

As a constructor, Speaker E tended to increasingly limit the interaction throughout the rounds. So, in Round 2, his first round as a constructor, he still occasionally interacted concerning the instructions received. Thus, he adopted certain description techniques such as referring to partial real-world or geometric figural descriptions and also used Speaker G’s denomination for the parallelogram: “the yellow thing”. (In Round 1, Speaker E had mentioned the fact that such a shape was possibly called a ‘parallelogram’; however as neither of them was sure of this, Speaker G decided to refer to it as the “ding” (German word for ‘thing’).) Then, in the next two rounds as a constructor (rounds 3 and 5), he tended to simply confirm each instruction by saying “Right, have that” or “All right, go on”, thereby disallowing the chance to adopt formulations used by Speaker G in his language.

However, as an instructor, Speaker E adopted many of Speaker G’s expressions and description techniques. In the first round, it was mostly correct genders and endings of words which were ‘copied’, such as “das Dreieck” instead of “der Dreiecke”, as well as certain expressions such as “das rosane”
for “the pink one”; also, Speaker G made Speaker E realise the importance of giving ‘left/right’ information, rather than just simply saying ‘beside’. Then, in Round 4 (his second round instructing), Speaker E reused the conventions adopted in Round 1, as well as four further expressions and description techniques from Speaker G’s speech:

• “Spitze nach oben” to refer to the location of the right angle of a triangle. This is a translation of Speaker G’s expression “its corner (...) upwards”

• “lange seite” (translated from Speaker G’s “long side”) to refer to the hypotenuse of a triangle

• “kurze seite” (translated from Speaker G’s “short side”) to refer to the other two sides of a triangle

• giving information about the position of the long side of the triangle: “unten links bis oben rechts” (=bottom left to top right), copied from utterances by Speaker G such as “the long side goes from down left to right up”.

In Round 6, most of these new ‘adoptions’ were re-used, and a few extra description techniques were adopted such as giving a general figural description at the start and checking during the round whether Speaker G was keeping up. There were also certain terms used by Speaker E, for which it was hard to determine whether he was simply translating Speaker G’s terminology or had actually thought of the word himself. For example, Speaker E used the word “beruehrt”, which may or may not have been a simple literal translation of Speaker G’s English word “touch”.

Another description technique which Speaker E acquired throughout the rounds was to only give one instruction at a time, rather than instruct the placement of two or three pieces within the same sentence. Also, Speaker E learned to wait until Speaker G had confirmed having understood any particular instruction before moving on to the next one.

On the whole, Speaker E tended to adopt quite a few turns of phrases and description techniques from Speaker G, resulting in his language in the last rounds being quite different to what he had used in the first rounds.

General Remarks

Speaker G never explicitly corrected Speaker E’s German. If Speaker E used an incorrect German word or simply a wrong ending or gender, Speaker
G just tried to use the correct form in his language, rightly expecting Speaker E to realise his mistake. On the other hand, Speaker E explicitly corrected Speaker G’s English. So, for example, Speaker G said “ok, I will describe the next form” and Speaker E replied “Shape, ok go on”, thereby indicating that the word “form” did not fit this context. Moreover, this mistake indicated to Speaker E that “form” was probably the literal translation of the appropriate German word, and he therefore used the word “Form” in his own German.

Both of the speakers’ knowledge of technical terms was quite limited. This was notably visible in the various terms used to refer to the right angle: “the small corner”, “the short corner”, “the corner”, “die obere Spitze” (=the upper peak), or simply “die Spitze” (=the peak); yet these imprecise and sometimes incorrect descriptions seemed to not create any confusion, until the last round where Speaker E used the word “spitze” when referring to another peak of the triangle. In some cases, this lack of technical knowledge led to problems right from the start, such as in round 5 where Speaker G said “now give it a little push to the left, ca 30 degree” and Speaker E gave it a 45 degree push or in round 1 where Speaker G used the word “symmetrisch” but Speaker E did not know what the word ‘symmetric’ meant. Thus in round 6, Speaker G had to use the word “spiegelverkehrt” (=inverted by a mirror) instead.

Despite such ‘explicit vocabulary problems’, both speakers tended to say they had understood a particular instruction, even though when one looks at their final construction, they clearly had not understood, and just said all was alright so as to move on to the next instruction. This is especially true of Speaker E who tended to not really pay attention to Speaker G’s instructions. In certain cases Speaker E explicitly showed his comprehension uncertainty through utterances such as “I think I follow, go on.”, but in others he simply says “All right, go on”, though the last instruction had actually not been correctly understood.

In other cases, the inaccuracy of the final construction was due to one piece being misplaced right at the start, thereby leading to the misplacement of the following pieces and to valuable time being lost trying to clear confusion caused by these misplacements. Sometimes, if one of the speakers was unsure of the clarity of his instruction, he would immediately restate it in one or two different ways, so that in the end, the same instruction was given two or three times with different words. But, in certain cases, the speakers did not realise how ambiguous their instructions were and how they could lead to many different positionings of the piece concerned, such as was the case in Round 5 when Speaker G instructed to put the parallelogram “from down left to high right” (see Figure 25).
Moreover, Speaker G clearly liked using figural descriptions, insisting on giving them when instructing and asking for them when constructing. Thus, Speaker E also started making use of partial figural descriptions. However, it was only in the last round that he managed to associate the general aspect of the figure he had to describe with an element of the real world. Before that, he had not noticed that the figures he had to instruct resembled anything concrete (a bridge and a T-Shirt - see Sheet 1, Appendix E, page 156).

Also, Speaker E, and sometimes Speaker G, tended to use less and less verbs as the experiment went on, and simply use a ‘telegraphic style’ instead, composed mainly of nominal sentences. So an example of his sentences in round 4 is “Rosa Viereck oben links, halb so lang wie die obere Seite des grossen Vierecks” (=pink square top left, half as long as the upper side of the big square).

**Third Pair**

The third pair was heavily affected by technical failures, which regularly interrupted the task and destabilised both participants. This must be taken into account when analysing the resulting conversations.

**Speaker G-German Native Speaker**

*Instructed Figures 1, 3 and 5-Sheet 1; Constructed Figures 1, 3 and 5-Sheet 2 (see Appendix E, page 156)*

As a constructor, Speaker G constantly simply said “yes” or “okay” in response to each one of Speaker E’s instructions, which were very clear and precise. Therefore, in these rounds (Rounds 2, 4 and 6), Speaker G clearly did not make use in his language of any of Speaker E’s expressions or description techniques. One of the drawbacks of simply saying “ok” all the time, is that Speaker E never realised that he was using the wrong gender for the German words for ‘triangle’ and ‘square’.
However, as an instructor, Speaker G did make use of certain of Speaker E’s conventions. So, for example, in round 5, Speaker G used four description techniques or expressions drawn from Speaker E’s utterances:

- using cardinal points in the descriptions, such as “hypothenuse to south east”
- “corner” instead of the word ‘angle’ (misspelt as “ankle” by Speaker G)
- “upwards” to express direction
- “move to left of long side” due to Speaker E using the verb “move” a few utterances beforehand in the same round

**Speaker E—English Native Speaker**

*Instructed Figures 1, 3 and 5-Sheet 2; Constructed Figures 1, 3 and 5-Sheet 1 (see Appendix E, page 156)*

The pattern is different for Speaker E. He tended to adopt many new expressions from Speaker G at the start, regardless of his role, but then, with time, progressively stopped adopting new ones.

As a constructor in Round 1, he adopted three new terms from Speaker G’s instructions: “short side”, “peak” and “hypothenuse”.

As an instructor in Round 2, he copied Speaker G by giving partial geometric figural descriptions and further adopted three new expressions from Speaker G’s utterances:

- “lange seite” for the long side of the triangle or of the parallelogram
- “eine linea mit der (...) macht” which is translated from Speaker G’s English construction “makes one line with the (…)”
- “stell zur rechten seite” which is translated from the incorrect English expression used by Speaker G in round 1: “put (…) its right short side to the right short side of the pink one”.

Then, in the following rounds, he tended to simply reuse these readily adopted conventions. However, contrary to Speaker G who, when constructing, simply said “okay” or “yes”, Speaker E tended to interact much more throughout his construction, either by asking questions or by asking Speaker G to slow down if a previous instruction had not yet been fully understood.
5 RESULTS AND ANALYSIS

General Remarks

Both speakers checked that the other speaker had understood a particular instruction, if they felt they may have stated it in an unclear manner. So, for example, in round 3, Speaker G said “take the pink one and put it together with the blue one that they make a quadrat” and because he felt the use of the German word “quadrat” may have rendered the instruction unclear, he then wrote “okay?”. Then, Speaker E replied “yep, a square”, thereby giving the English word to Speaker G. Speaker G also helped out Speaker E with unknown German words when necessary.

Moreover, all through the experiment, there was a confusion due to what Speaker G referred to as the “normal position” of a triangle, pictured in Figure 26. This terminology was introduced right at the start of round 1 when Speaker G said “If you imagine a triangle in normal position, I am talking about its left side.” Speaker G then assumed that it was clear to Speaker E that a triangle was in normal position when its hypotenuse was horizontal and at the bottom, and the right angle was facing up. Therefore he took it for granted that he could then refer to the left and right sides of the triangle, with respect to this normal position. However, Speaker E did not understand this concept of a “normal position” but, perhaps due to the interruptions caused by technical failures, only made this clear to Speaker G at the end of round 5. In this last round, Speaker G regularly used expressions such as “the left corner”, “the left short side”... and when Speaker E asked for extra clarification, Speaker G simply replied “allright, I always mean left and right in relation to its normal position (...)” to which Speaker E replied “what is it’s normal position!” . Then Speaker G explained, and Speaker E finally understood the “normal position” concept. Surprisingly, despite their numerous computer problems and the complete lack of coordination on the expression “normal position”, their performance on a whole was very good.
• Fourth Pair

This pair was also affected by computer problems, though to a lesser extent than the previous pair; round 2 and round 4 especially had to be interrupted.

Speaker G-German Native Speaker
*Instructed Figures 1, 3 and 5-Sheet 1; Constructed Figures 1, 3 and 5-Sheet 2 (see Appendix E, page 156)*

As was the case for most of the aforementioned participants, as a constructor, Speaker G only adopted very few expressions from Speaker E, despite the fact that his utterances were, for the most part, not simply restricted to “ok” or “yes”, but were rather questions asking for more information. However, when considering the lack of coordination, it must be taken into account that the two rounds which were interrupted were both rounds where Speaker G was the constructor.

As an instructor, Speaker G adopted an increasing number of expressions from Speaker G throughout the rounds. So, in round 1, he made use of two conventions introduced by Speaker E; in round 3, he made use of three further conventions from Speaker E; and finally in Round 5, he adopted five further ones, including:

- “diamond” to refer to the specific positioning of the square; this is taken from Speaker E’s use of the word in Round 1
- “3angle” as an abbreviation for ‘triangle’; this is adapted from Speaker E’s word “3ecke” in German
- “in the middle” to refer to the position of the right angle of a triangle; this is translated from “in der Mitte” uttered by Speaker E in Round 4.

Also, throughout the experiment, Speaker G adopted a description technique introduced and heavily used by Speaker E, which consisted in giving partial real-world or geometric descriptions within each round, to support the instructions.
5 RESULTS AND ANALYSIS

Speaker E-English Native Speaker
*Instructed Figures 1, 3 and 5-Sheet 2; Constructed Figures 1, 3 and 5-Sheet 1 (see Appendix E, page 156)*

As a constructor, if an instruction was perfectly clear, Speaker E replied to it by saying “ok” or “done”. However, in most cases, a clarification was requested. This could take the form of a check by means of a figural description, such as in round 5: “ok, so it looks like a standing up cat?” Clarification could also take the form of a very detailed question, enumerating various possible answers, such as “where are the two pieces touching? at the corners? which corners? or a side, if so which side?” (Such questions were quite frequent, due to Speaker G typically omitting information about contact or lack of contact between pieces.) Yet, despite the frequent questions asked by Speaker E, he hardly made use of any expressions or description techniques previously introduced by Speaker G.

Similarly, as an instructor, Speaker E did not make use of very many of Speaker G’s formulations. In Round 2, he made use of two terms introduced by Speaker G: “90deg” for the right angle, an abbreviation of Speaker G’s actual expression “90degree”, and “daneben” to indicate contact between two pieces; and he also gave a general real-world figural description at the start, just as Speaker G had done in Round 1. However, in rounds 4 and 6, there were hardly any new conventions adopted. The only new one in Round 6 was that Speaker E finally realised the correct gender of the German word ‘triangle’ and adopted it in his language.

So, on a whole, Speaker E did not tend to adopt many of Speaker G’s expressions or description techniques, but rather introduced many new formulations throughout the numerous interactions. Speaker E also used a telegraphic style avoiding all verbs, as well as many abbreviations, such as “gr” for “gruen” and “drei” for “dreieck” but these ‘short-cut conventions’ tended not to be adopted by Speaker G.

**General Remarks**

Both speakers regularly asked whether they had been clear, if they thought they may not have been. So for example in Round 2, Speaker E wrote “verstehst du?” (= do you understand?) just after an instruction including many abbreviations used for the first time. Similarly, in Round 5, Speaker G wrote “you know?” just after an instruction which he realised was not very clear: “so there is a little foot(the blue triangle) the last part is the pink triangle the long side og [sic] the pink is touching the yewllow [sic], you know?”
However, on analysis of the whole data from this pair, it emerged that both speakers tended to be quite unclear in their instructions, leading to quite a lot of confusion on both sides.

5.3.2 The Community Group Condition

To analyse coordination in the community group condition, I examined, for each participant, the data of the six rounds he was involved in, noting any expression or description technique which may have been copied from one of his previous interlocutors, and in such cases, from which one.

The English Native Speakers

• Participant 1E

*Instructed Figures 3, 5 and 1-Sheet 1; Constructed Figures 1, 5 and 3-Sheet 2 (see Appendix E, page 156)*

In Round 1, Participant 1E instructed Participant 5G, and did not show any explicit sign of having adopted any of his formulations.

In Round 2, Participant 1E received instructions from Participant 6G, and used one of the techniques which Participant 5G had used in the previous round, which consisted in checking the construction so far thanks to a general figural description. Participant 1E also made use of Participant 6G’s technique of giving partial figural real-world descriptions to serve as reference points.

In Round 3, Participant 1E instructed Participant 7G, and once again made use of this technique of giving partial figural real-world descriptions, taken from Participant 6G. Participant 1E also employed the term “spitze” to refer to the right angle, which may have been copied from Participant 6G’s English word “point” to refer to the right angle, used in the previous round. However, this term “spitze” created confusion, because Participant 7G took “spitze” to be any point of a triangle and “obere spitze” (=upper point) to be the right angle. Similarly, Participant 1E referred to the hypotenuse of a triangle as the “untere seite” (=under side) whereas Participant 7G referred to it as the “laengere seite” (=longer side). So, Participant 1E clearly did not explicitly adopt any techniques or expressions from Participant 7G (note their degree of correctness in this round: 2).

In Round 4, Participant 1E received instructions from Participant 8G and further used Participant 6G’s conventions, which had been adopted in Round 2: giving partial figural real-world descriptions, and referring to the right angle as the “tip”. No expressions from Participant 8G were copied.
In Round 5, Participant 1E instructed Participant 5G again, and demonstrated having adopted expressions from the various interlocutors from the previous rounds. The term “parallelogram”, which had been introduced by Participant 7G in Round 3, was employed for the first time; the expression “die Spitze berühren sich” appears to be translated from Participant 8G’s expression in Round 4: “the (...) corner touch (...) the corner”; and the expression “die Spitze zeigen nach oben” appears to be translated from Participant 6G’s expression in Round 2: “the point pointing upwards”.

Finally, in Round 6, Participant 1E received instructions for the second time from Participant 6G, and once again employed the verb “touching” which had been introduced by Participant 8G in Round 4.

As an instructor, Participant 1E gave instructions which were not detailed enough, so that the respective constructor had to regularly ask for more information. For example, Participant 1E would say “eine kurze seite muss (...)” (=a short side [of a triangle]) without specifying which one. In some cases, Participant 1E did not even answer the question asked by the constructor, or the constructor did not bother to ask a question, and therefore he made do without the extra information, and just assumed the placement of pieces, hence the relatively low degree of correctness in rounds where Participant 1E was an instructing: 3.

As a constructor, Participant 1E was very active, regularly asking questions to get more information regarding the exact position of pieces. However, he often misread instructions, such as reading “left” for “right” and vice-versa (Rounds 2 and 6) or reading “triangle” for “square” (Round 4). Also, in some cases, he did not realise an instruction was ambiguous and just placed the piece instinctively. Therefore the constructions were often wrong, which is reflected by his low degree of correctness as a constructor: 2.

- Participant 2E

  Instructed Figures 1, 5 and 3-Sheet 1; Constructed Figures 1, 5 and 3-Sheet 2 (see Appendix E, page 156)

In Round 1, Participant 2E instructed Participant 8G, and readily adopted two new expressions from him: the verb “berührt” to indicate contact between two points, and the terminology “kurze” and “lange seite” to refer to the short and long sides of a triangle. He also corrected his spelling of the German word for square “quadrat” (previously misspelt as “kvadrat”), thanks to Participant 8G using the word himself with its correct spelling. Moreover, Participant 1E made use of two new description techniques, introduced by Participant 8G: He realised the importance of giving ‘left/right’
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Figure 27: A triangle whose hypotenuse “goes from top left to bottom right”

information rather than just stating closeness, and also started giving information about the exact position of the hypotenuse of the triangle (whether it “goes from top left to bottom right”, or “bottom left to top right” - see Figure 27).

In Round 2, Participant 2E received instructions from Participant 5G, and continued making use of the expressions and techniques adopted in the previous round from Participant 8G, rather than using any new formulations introduced by Participant 5G.

In Round 3, Participant 2E instructed Participant 6G, and not only continued using the conventions adopted in Round 1 from Participant 8G, but also employed certain description techniques which Participant 5G had introduced in the previous round, such as regularly checking whether any particular instruction was perfectly clear or not before moving on to the next one, and giving real-world figural descriptions where these would support the instructions. Also, Participant 2E referred to the right angle as the “Spitze” (=point), which may have been influenced by Participant 5G referring to it as the “corner” in the previous round. This term was then adopted by Participant 6G, who contributed to the dialogue a circumlocution for the unknown term ‘parallelogram’: “grunes ding” (=green thing).

In Round 4, Participant 2E received instructions from Participant 7G, and did not demonstrate adoption of any new expressions.

In Round 5, Participant 2E instructed Participant 8G once again, and employed many of the expressions which had previously been adopted into his language, such as the “grunes ding”, the “spitze” and gave the exact description of the position of the hypotenuse of a triangle; but he also made use for the first time of certain expressions which had been introduced in previous rounds. So for example, he used the expression “auf dem boden” for the first time, which seems to be translated from the expressions “on the ground” or “at the bottom” formulated by Participant 5G in round 2, and the expression “weist nach (...)”, which seems to be translated from the expres-
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Figure 28: Example of a triangle “show[ing] to the bottom”

... formulation by Participant 7G in the previous round (see Figure 28). Moreover, the word “symmetrisch”, used by Participant 7G in this round, is copied by Participant 2E.

In Round 6, Participant 2E received instructions from Participant 5G for the second time, and used the same conventions previously adopted from participants 7 and 8. Moreover, Participant 2E finally employed the correct term “parallelogram”, thanks to Participant 7G using the word in Round 4, but it then became the “yellow shape”, due to Participant 5G using such terminology in this round.

As an instructor, Participant 2E generally gave good instructions, though occasionally lacking detail, due to him not realising that one instruction could lead to many different positionings. Also, he tended to leave the constructor take the lead and set his own conventions for the description, and then would simply adopt those. Moreover, rather than using the position of the right angle to describe the placement of a triangle, Participant 2E tended to mention whether pieces touched or not and if so, with which sides.

As a constructor, Participant 2E regularly asked detailed questions to gather extra necessary information. Sometimes, he asked a question but then solved it himself (Rounds 2 and 6). Also, if he was not absolutely certain of having perfectly understood a particular instruction, he often asked a question or gave a figural-type description, such as “so basically there are no spaces at all!” or “now i have a tower!” to check that he had correctly placed the piece in question.

- Participant 3E

Instructed Figures 1, 5 and 3-Sheet 1; Constructed Figures 1, 5 and 3-Sheet 2 (see Appendix E, page 156)

In Round 1, Participant 3E instructed Participant 7G, and, similarly to Participant 7G, started giving ‘left/right’ details, instead of simply saying “top” (oben) or “bottom” (unten).
In Round 2, Participant 3E received instructions from Participant 8G, and did not make use of any expressions from Participant 8G nor from Participant 7G.

In Round 3, Participant 3E instructed Participant 5G, and used the word “grenzen” introduced by Participant 5G to indicate contact between pieces. Also, Participant 3E referred to the pink square as the “rotes” (=red) square, just as Participant 8G had done in the previous round. At the start of the round, Participant 3E referred to the right angle as the “spitze”, which Participant 5G seemed to understand perfectly, until he suddenly had a doubt and asked “die ecke die zwischen den kurzen seiten liegt?” (=the corner which lies between the two short sides?). Hence, Participant 3E decided to adopt again the name he had used in the first round for the right angle: “90 grad winkel” (=90 degree angle).

In Round 4, Participant 3E received instructions from Participant 6G, and just as in round 2, did not make use of any conventions introduced by other participants, not even those of his conversation partner.

In Round 5, Participant 3E instructed Participant 7G, and continued referring to the pink square as the red square, just like Participant 8G had done in round 2. He also gave an exact description of the position of the hypotenuse of the triangle, which is a description technique also introduced by Participant 8G in round 2. Furthermore, he used partial figural descriptions to support his instructions, just as participants 8 and 6 had done in the previous rounds.

In Round 6, Participant 3E received instructions from Participant 8G again, without making use of any conventions introduced by any other participants.

Therefore, on a whole, Participant 3E tended to not make much use of expressions and techniques introduced by other speakers, except a few ones introduced mostly by participants 7 and 8.

As an instructor, Participant 3E was very concise and only stated the necessary information, thereby cutting out all the verbs from his instructions. In the last round, his instructions became slightly longer as he appealed much more to figural descriptions to help the constructor. On a whole, he tended to lead the conversation by imposing his conventions and left only little space for interaction.

As a constructor, Participant 3E usually simply carried out the instructions given, only asking a question if he was very confused or was really lacking important information. For example, in round 2, he received a new instruction which contradicted what he had already built, and therefore asked “is it not the yellow triangle on the right?” It must be noted though that
Participant 3E was instructed twice by Participant 8G who gave particularly complete instructions.

- **Participant 4E Instructed Figures 3, 5 and 1-Sheet 1; Constructed Figures 1, 5 and 3-Sheet 2 (see Appendix E, page 156)**

  In Round 1, Participant 4E instructed Participant 6G, and simply made use of his own expressions and description schemes.

  In Round 2, Participant 4E received instructions from Participant 7G, and proceeded similarly.

  In Round 3, Participant 4E instructed Participant 8G, and, for the first time, demonstrated signs of coordination. He gave a description of the general aspect of the figure at the start of the round, which Participant 7G had also done at the start of round 2, and used the correct word “parallelogram”, also introduced in the previous round by Participant 7G, rather than referring to the shape as “dieses ding, das nicht ein quadrat/dreieck ist” (= the thing, that is not a square/triangle) like in round 1. Moreover, Participant 8G made him realize that the colours of the pieces were also relevant, and from then on, Participant 4E always referred to each shape by its name and its colour. Due to the vagueness of Participant 4E’s instructions, Participant 8G had to ask many precise questions, which tended to be answered using Participant 8G’s terminology.

  In Round 4, Participant 4E received instructions from Participant 5G, and, as in the first rounds, did not make use of any expressions or techniques, except ones he had come up with himself.

  In Round 5, Participant 4E instructed Participant 6G again, and this time not only made use of conventions introduced by Participant 7G in Round 2 (the word “parallelogram” and the general figural description at the start), but also used expressions introduced by Participant 8G in round 3: “beruehren” (=touch) to indicate contact between pieces, “lange seite” (=long side) to refer to the hypotenuse of a triangle and “freie ecke” (=free corner) to refer to any corner of a piece which is not yet touching anything. However, none of Participant 6G’s expressions were ‘copied’.

  In Round 6, Participant 4E received instructions again from Participant 7G, and restricted himself to only using his own personal expressions.

  Therefore, on a whole, similarly to Participant 3E, Participant 4E did not tend to adopt many conventions introduced by other participants, but on the occasions when he did, they were mostly taken from participants 7 and 8.
As an instructor, Participant 4E was not very precise, especially in the first round when he had not yet realized that the colours of the pieces were relevant, and therefore omitted any colour information. Also, he did not give much detail concerning the exact orientation of pieces, but rather simply stated where the pieces should be with relation to one another. Thus, the constructor had to ask many questions, which were sometimes answered using the constructor’s terminology, or sometimes not answered at all.

As a constructor, Participant 4E occasionally asked questions to get more information, but in many cases, he simply said “ok” or “yeah”. This meant that he would either risk placing shapes rather than checking for their exact placement, or simply misplace them because of not paying full attention to the instructions given. Also, until he realised the importance of the colours of the pieces, he wasted time and effort trying to understand which piece was being referred to (Round 2). It must also be noted how strikingly similarly participants 1 and 4 describe Figure 29 in round 5:

They both start by instructing the parallelogram shape formed by the two big triangles:

Participant 1E: “nemm dass rosa und blaue dreieck um damit ein parallogram [sic] zu formen” (=take the pink and blue triangle so as to form a parallelogram with them)
Participant 4E: “nehm die 2 grosse dreiecke bitte -rosa und blau (...) damit sie ein ‘parallelogram’ bilden” (=take the two big triangles please - pink and blue (...) so that they build a parallelogram)

Then, they instruct the placement of the green parallelogram:

Participant 1E: “nimm grune parallolgram [sic] und leg es auf die andere site [sic] dass die spitzen vom blauen mit dem gruenen sich beruehren” (=take the green parallelogram and put it on the other side such that the points of the blue and the green touch each other)
Participant 4E: “dann nehm das gruene parallelogram (...) die freie ecke des blauens beruehrt das parallelogram.” (=then take the green parallelogram (...) the free corner of the blue one touches the parallelogram.)

Then, they both mention a gap in the construction:

Participant 1E: “aber zwischen ein platz ist” (=but between is a place)
Participant 4E: “gibt es platz unten” (=there is place under)

And then instruct the placement of the yellow triangle:

Participant 1E: “wo dann dass gelbe dreieck rein muss.” (=where then the yellow triangle must fit into)
Participant 4E: “das gelbe dreieck ist unten in der mitte.” (=the yellow triangle is under in the middle)

Finally, they instruct the three remaining pieces:

Participant 1E: “dass gruene dreieck muss so hin dass mit dem rosa und gruenen zusammen es ein extra langes parallelogram [sic] ergibt” (=the green triangle must be such that with the pink and green together an extra long parallelogram results)
Participant 4E: “ok dann mit den 2 anderen dreiecke und dem quadrat musst du ein p. bilden” (=ok then with the other two triangles and the square you must build a parallelogram)

The German Native Speakers

• Participant 5G

Instructed Figures 1, 5 and 3-Sheet 2; Constructed Figures 3, 5 and 1-Sheet 1 (see Appendix E, page 156)

In Round 1, Participant 5G received instructions from Participant 1E, and adopted his way of referring to the parallelogram as the “gruenes langes viereck” (=green long rectangle).

In Round 2, Participant 5G instructed Participant 2E, and just as Participant 1E had done in the previous round, he gave partial figural geometric descriptions and regularly checked if the instructions given had been clearly understood. Also, he adopted Participant 1E’s term “the big square” to differentiate between the piece in shape of a square, and the square which can be formed with two triangles side by side (see Figure 30).
In Round 3, Participant 5G received instructions from Participant 3E, and started referring to the pink square as the “rote” (=red) square, thanks to Participant 3E referring to it in that way. Also, Participant 5G used the expression “kurze seite” (=short side) introduced by Participant 1E in round 1 to denote the short side of a triangle.

In Round 4, Participant 5G instructed Participant 4E, and made use of many referring expressions introduced in the previous rounds. So, he used “short side” with respect to a triangle (introduced by Participant 1E in round 1), “touches” to indicate contact (introduced by Participant 2E in round 2), as well as four new expressions introduced in the previous round by Participant 3E: “90 degree angle” to refer to the right angle (translated from “90 grad Winkel”); the “upper” or “bottom corner” of a square (translated from “die untere Ecke des Quadrats”), the notion of vertical (“in vertically direction”) due to the previous use of the word “senkrecht” (=vertical) and the verb phrase “shows to the left” as an indicator of position (translated from “zeigt nach links”) (see Figure 31).

In Round 5, Participant 5G received instructions again from Participant 1E, whose conventions he appeared to understand well. Moreover, he further used the expression “zeigt (..) nach”, which had been used in round 3 by Participant 3E and in this round by Participant 1E.

In Round 6, Participant 5G instructed again Participant 2E, and made use of techniques and expressions introduced by Participants 2E and 3E. He continued using expressions such as “90 degree corner”, “shows”, “vertical” which were all taken from Participant 3E (round 3), and also used the expression “it fits (..) between (..)” for the first time, which appears to be a literal translation of Participant 3E’s phrase “es passt (...) zwischen (...)”, introduced in round 3. Moreover, he used one technique adopted from Partic-
Figure 31: A triangle “show[ing] to the left”

Participant 2E, consisting in mentioning the lack of gaps between pieces; however this technique was displayed by Participant 2E in round 2, not in round 6.

As an instructor, he tried to be as clear as possible, but did tend to be incomplete in his instructions, which, on the one hand, meant he was depending on the constructor asking the relevant questions, but on the other that he had time to instruct the whole figure (note his average degree of completeness as an instructor: 5). Also, he regularly checked that the constructor was keeping up, and often made use of figural descriptions to support his instructions (especially in rounds 2 and 6).

As a constructor, Participant 5G asked for more details or for confirmation every time he was unsure of an instruction. However, in certain cases, the necessary details were not given, and therefore he simply had to guess how to orient the shape in question, and often got it wrong. Moreover, he seemed aware of the time factor, and therefore anticipated instructions, by asking questions such as: “ich habe noch ein grünes dreieck, was soll ich damit machen?” (= I still have a green triangle, what should i do with it?) Furthermore, he did not insist on imposing his own conventions. If he liked one of his conversation partner’s conventions, he made this clear thanks to utterances such as “danke sehr gute info” (= thanks very good info) and if not he would attempt to introduce his own but would still mention the old one for clarity purposes. For example, in round 1, the instructor referred to a square as a “viereneck” whereas Participant 5G would rather have called it a “quadrat”; therefore, when introducing the term “quadrat”, he wrote: “quadrat (viereneck)”.
• Participant 6G

Instructed Figures 1, 5 and 3-Sheet 2; Constructed Figures 3, 5 and 1-Sheet 1 (see Appendix E, page 156)

In Round 1, Participant 6G received instructions from Participant 4E, and did not use any expressions ‘belonging’ to Participant 4E.

In Round 2, Participant 6G instructed Participant 1E, and gave indications of ‘left/right’ or of ‘level’ (“on top of”), just as Participant 4E had done in the previous round. He also gave partial figural geometric descriptions, just like Participant 4E had done, and then extended this to partial real-world descriptions, after Participant 1E giving one in this round. Moreover, Participant 6G used the verb “to face” to indicate the orientation of a triangle, after Participant 1E employed the term.

In Round 3, Participant 6G received instructions from Participant 2E, and continued using Participant 4E’s techniques from round 1 consisting of checking the construction so far thanks to figural descriptions and giving ‘level’ indications where possible (“ist unten dran”). Moreover, Participant 6G referred to the parallelogram as “das grüne ding” (=the green thing), just as Participant 1E had done in the previous round. Furthermore, Participant 6G used some terms introduced by Participant 2E in this round, such as the verb “berührt” (=touch) to indicate contact, and the word “spitze” (=peak) to refer to the right angle. In this round, there was also a temporary communication problem when Participant 6G used an Austrian word (“Mascherl”) instead of its “Hochdeutsch” equivalent (“Fliege”), which Participant 2E did not understand; however, this did not seem to affect their coordination or their task performance.

In Round 4, Participant 6G instructed Participant 3E, and, as in previous rounds, gave partial geometric figural descriptions (convention introduced by Participant 4E) and used the verb “face” introduced by Participant 1E. Moreover, he used many expressions introduced in the previous round by Participant 2E: “the longest side” to refer to the hypotenuse of a triangle (translated from “die längste seite”) and the “shorter sides” to refer to the other two sides of a triangle, as well as the expressions which he had already incorporated into his language in the previous round: “touch” to indicate contact, which is translated from “berührt” and the “point” to refer to the right angle, which is translated from “spitze”. This last term caused confusion as he also used “point” to refer to the other corners of the triangle.

In Round 5, Participant 6G received instructions again from Participant 4E, and finally adopted the correct term for “parallelogram” thanks to Participant 4E using it. Also, a confusion occurred in this round between the two speakers concerning the colours of the beige triangle and the yellow triangle,
as Participant 6G considered the beige triangle to also be yellow. They finally reached a consensus on the names of the colours: “hautgefarbt” (=skin coloured) for the beige one, and “richtig gelb” (=really yellow) for the yellow one.

In Round 6, Participant 6G instructed again Participant 1E, and, instead of adopting any new expressions, simply re-used ones which he had previously adopted as his own conventions, such as the “point” to refer to the right angle (from Participant 2E in round 3) and “parallelogram” (from Participant 4E in round 5). He also tried to refer to the blue triangle as being “purple”, but noticed that this confused Participant 5G, and therefore switched back to calling it “blue”.

As an instructor, Participant 6G gave clear and detailed instructions, often involving figural descriptions, and tried to introduce certain conventions. He regularly described what the figure should look like so far, to make sure the constructor was following.

As a constructor, Participant 6G asked questions when unsure of something. However, in certain cases, even the answers to these questions did not provide sufficient information, or he did not pay full attention to what the instructor said, and thus placed the piece in question incorrectly.

On the whole, he was very conscious of the time factor. As an instructor, he was very efficient and quick, and as a constructor, he regularly asked questions such as “Was jetzt?” (=what now?) or “was soll ich jetzt machen?” (=what should i do now?), to accelerate the instruction giving process. (Note that he achieved an average degree of completeness of 5 both as constructor and instructor)

- Participant 7G

In Round 1, Participant 7G received instructions from Participant 3E, and made use of two new expressions introduced by Participant 3E: “die laengste seite” (=the longest side) to refer to the hypotenuse of a triangle, and “schraeg nach oben” (=slanted upwards) to indicate the orientation of the parallelogram (see Figure 32).

In Round 2, Participant 7G instructed Participant 4E, and employed certain expressions which Participant 3E had introduced in the previous round, such as the exact term for “parallelogram” and “90 degree edge” to refer to the right angle (roughly translated from the German “90 grad Winkel”), but
also “longest side” to refer to the hypotenuse of a triangle. He also had certain vocabulary problems: “quadrat” instead of “square” and “three edge” instead of “triangle”, so Participant 4E had to give the correct English words.

In Round 3, Participant 7G received instructions from Participant 1E, and began giving information about the relative levels of pieces (“unten”) after Participant 1E had done so. However, there were other expressions on which they did not converge at all such as the term for a right angle (“spitze” according to Participant 1E versus “obere spitze” according to Participant 7G). Moreover, he continued using previously adopted expressions, which had been introduced in round 1 by Participant 3E, such as “parallelogram” and “die laengste seite” (for the hypotenuse of a triangle), despite Participant 1E referring to the latter as the “untere seite” (=bottom side).

In Round 4, Participant 7G instructed Participant 2E, and used certain expressions taken from previous interlocutors. So, for example, he continued using the expressions “parallelogram” and “90 degree edge” from Participant 3E, as well as using for the first time from Participant 1E, the term “diamond” to indicate the position of the parallelogram and expressions such as “the top” or “the peak” to refer to the right angle (possibly inspired by the expression “die obere Spitze” (=the top peak) used by Participant 1E in the previous round to refer to the right angle). Also, Participant 7G indicated contact thanks to the verb “touch”, after Participant 2E doing so in this fourth round.

In Round 5, Participant 7G received instructions again from Participant 3E, and asked for a partial figural description, after Participant 3E having given many of them in this fifth round.

In Round 6, Participant 7G instructed again Participant 4E, and used the word “diamond” again to refer to the position of the parallelogram (term taken from Participant 1E in round 3). He also indicated the orientation of the right angle by saying “90 degree edge shows left up” which is probably a translation of the sentence written in the previous round by Participant 3E:

![Figure 32: A parallelogram “schraeg nach oben” (=slanted upwards)](image)
“90 grad winkel oben links”. Moreover, Participant 4E introduced in this round the notion of bits “sticking out” if they were not touching any other surface; Participant 7G adopts this and later says “the edge of the white and the edge of the green triangle are sticking out a little bit.” (see Figure 33)

As an instructor, Participant 7G was not always precise, but tried to compensate by using lots of figural type descriptions to support the instructions. Furthermore, he was not always very consistent in his use of terminology. For example the word “edge” was sometimes used to mean ‘side’, sometimes to mean ‘corner’.

As a constructor, Participant 7G sometimes asked questions or requested a figural-type description, if lacking information or if an instruction was not clear. However, in other cases, he simply made assumptions and hence built incorrectly. He also tended to keep to his own terminology, rather than conform to or adopt that of the instructor.

- **Participant 8G**

  *Instructed Figures 1, 5 and 3-Sheet 2; Constructed Figures 1, 5 and 3-Sheet 1 (see Appendix E, page 156)*

  In Round 1, Participant 8G received instructions from Participant 2E. He asked many questions, thereby imposing his own conventions, rather than adopt any of Participant 2E’s conventions.

  In Round 2, Participant 8G instructed Participant 3E and proceeded similarly, in a very ‘independent’ fashion.
In Round 3, Participant 8G received instructions from Participant 4E, and used two of the latter’s expressions: “Diamanten” (=diamond) to refer to the position of the square and “das rosa dreieck” (=the pink triangle), thereby indicating that Participant 8G no longer considered that particular triangle to be red, as he did in the previous round.

In Round 4, Participant 8G instructed Participant 1E, and made use of a few description techniques which Participant 4E had introduced in the previous example: he checked if instructions had been clearly understood before moving on, he gave a description of the general aspect of the figure at the start (a rabbit), and then associated each shape with a part of the body to help the constructor. He also used the verb “meet” to indicate contact, which appears to be translation of the verb “treffen” employed by Participant 4E in the previous round. Participant 8G also made use of an expression introduced by Participant 1E in this fourth round: the term “mountain” to refer to the shape of a gap between two pieces (see Figure 34). Unfortunately, his first instruction was ambiguous, without him realising it, thereby leading to Participant 1E’s construction being incorrect and both participants being very confused. (Participant 8G: “now, oh dear, now I’m confused. well, maybe it is a mountain”)

In Round 5, Participant 8G received instructions from Participant 2E. Giving a description of the general aspect of the figure had become a convention for him (taken from Participant 4E) and he therefore requested one at the start from Participant 2E. Furthermore, the pink triangle was still considered to be “pink” and not “red”, as Participant 4E had indicated to him in round 3. He also made use of certain expressions introduced by Participant 2E, either back in round 1, such as “das gruene ding” to refer to the parallelogram, or in round 5, such as “weist nach unten” (=facing downwards) to
indicate the orientation of a shape.

In Round 6, Participant 8G instructed Participant 3E, and made use of conventions previously adopted, such as “facing down” (from Participant 2E in round 5), “the yellow thingy” (from Participant 2E in round 1) and habits such as giving a description of the general aspect of the figure at the start and regularly checking whether instructions were being clearly understood. These were all acquired from Participant 4E in round 3.

As an instructor, Participant 8G was usually very precise and complete, setting up his terminology, containing many technical terms, and his description techniques as conventions. He even sometimes made instructions unnecessarily complicated because of wanting to give so much detail. Also, he regularly used figural-type descriptions to make sure that the constructor was keeping up.

As a constructor, Participant 8G knew what information he wanted and in which form he wanted it. So, if he was not satisfied with the instructions he received, he imposed his own conventions, by regularly asking very specific questions, such as “noch eine Frage: verlaeuft nun die lange Seite des Dreiecks von links oben nach rechts unten oder von links unten nach rechts oben?” (=one more question: does the long side of the triangle go from the top left to the bottom right or from the bottom left to the top right?) (note his average degree of correctness as a constructor: 5)

5.3.3 Comparison of the two conditions

In the monogamous pairs condition, it generally appeared that within each pair, one participant took on the role of ‘convention introducer’ and the other that of ‘convention adopter’, as is reflected by the amount of conventions adopted by each participant (except in the case of the third pair, where both participants seemed to maintain their own conventions). Moreover, the constructors in this ‘monogamous pairs’ condition seemed to only very seldom make use of conventions introduced by the conversation partner. Rather, they tended to simply “yes” or “ok” to each instruction received, only asking questions if absolutely necessary. Even in cases where questions were asked, the constructor usually kept to his own conventions, rather than conform to the instructor’s terminology. The amount of coordination observed on behalf of the instructors depended on whether they were more of the type ‘convention introducer’ or ‘convention adopter’. If of the former type, then they only seldom adopted conventions from the conversation partner (approximately three); if of the latter type, then they adopted many conventions from the conversation partner, usually approximately ten over the
whole experiment.

In the community group condition, individual differences between the participants certainly appeared. For example, certain participants were much more attentive than others who often misread important information in the instructions, such as Participant 1E. Moreover, the aforementioned contrast between ‘convention adopter’ and ‘convention introducer’ emerged again. Certain participants, such as Participant 2E, were clearly ‘convention adopters’, leaving it up to the conversation partner to impose his own conventions. Others, on the contrary, were clearly ‘conversation introducers’, insisting on using their own conventions and imposing them on their conversation partner, such as Participant 8G. Others again changed ‘attitude’ at each round.

Constructors could be divided into two groups. Certain proceeded in a similar fashion to pairs in the previous condition. They simply said “ok” or “yes” after each instruction, whether it had actually been understood or not, such as Participant 3E. Others acted contrary to the monogamous pairs condition; they tended to be more active, rather than simply say “yes” or “ok” after each instruction. In this latter category, two further types of attitudes emerged. Certain participants such as Participant 6G seemed ready to conform to the instructor’s terminology and, in their questioning, used conventions introduced by the instructor, thereby changing their own expressions. Others, such as Participant 8G, formulated their questions in such a way that they managed to impose their own conventions on the instructor, thereby keeping their own terminology and never altering their language. This increase in interaction on behalf of the constructors tends to suggest that the instructors were less efficient or successful in their instructing. As stated above, instructors were often quite incomplete in their instructions, sometimes lacking important details, sometimes simply giving ambiguous instructions. Even when asked for clarification or extra information, some tended to reply evasively, such as Participant 4E. Therefore, constructors often had to place pieces without knowing exactly how to do so.

One obvious difference which is clearly imposed by the difference in experimental conditions is the number of sources drawn on for new expressions. In the first two rounds, pairs from the two conditions may seem to have behaved approximately similarly, each drawing on only one source for adopting new conventions. However, as members of the community group encountered more participants, they drew on more than one source for the conventions they used. Generally, by the last round, they made use of conventions which had been introduced by two if not three different former conversation partners.

In Table 5, I have summarised the results discussed previously in Section 5.3.2. Each participant has his own row and his conversation partners are
listed in the columns. Each cell is divided into four parts, according to the
model pictured in Table 4 hereunder:

<table>
<thead>
<tr>
<th>Round Number</th>
<th>Degree of Correctness/Degree of Completeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propensity to adopt conventions</td>
<td>Propensity to introduce conventions</td>
</tr>
</tbody>
</table>

Table 4: A sample cell from Table 5

Both the propensity to adopt conventions (from either a previous or the
current conversation partner) and the propensity to introduce conventions
were rated on a scale from 1 to 5, where 1 is the lowest and 5 the highest.\(^4\)
Similarly, the degrees of correctness and completeness were rated on a scale
from 1 to 5, just as in Section 5.2.2 on page 71.

5.4 Participants’ Impressions

At the end of the experiment, I gathered information and comments regarding
the task. Certain participants were asked verbally what they thought and then asked to write a short paragraph with their thoughts on the experiment, others were handed out a short questionnaire to fill in (see Appendix H, page 161 and Appendix L, page 187). It must be reminded that these comments were simply based on a self-perception of the participant’s own performance, and hence were rather subjective and did not systematically have any concrete realisation. Rather, such observations were typically false.

5.4.1 The Monogamous Pairs Condition

- First pair

Speaker G-Sheet 2

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 2 and then Figure 1. He also thought he had improved at building, and was sure that he had improved at instructing (though this was not significantly reflected in the performance rates achieved). Moreover, when asked if he thought he had always been talking to the same person, he replied that he

\(^4\)Only occurrences of first-time adoption of a particular convention were taken into account. This convention could be introduced by the current conversation partner or have been introduced a by a previous one.
Table 5: A summary of the results from the community group

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<thead>
<tr>
<th></th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>P7</th>
<th>P8</th>
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<tbody>
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<td>P1</td>
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</tbody>
</table>

Table 5: A summary of the results from the community group.
thought he had spoken to two different people and was “astonished to have only ‘talked’ to one person”.

When asked what he thought of the experiment as a whole, he felt that the English native speakers (who had Sheet 1) had harder figures to instruct than he had. He further commented:

Even though I don’t like that computer-way of communication at all (I have never used chat-rooms, because I don’t like them), I found working on it really interesting. This is because I was able to experience, where the problems in that way of communication are. One can’t give the opposite partner an image of the figure. And moreover - the way of ‘speaking’ with the computer by typing words on the keyboard is very unnatural. (...) And giving the shape of the figure to the partner was only possible by presenting him/her an image of it before you begin to place the triangles etc.

Speaker E-Sheet 1

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 1 and then Figure 2. He also thought he had not improved at building, but had improved at instructing. Moreover, when asked if he thought he had always been talking to the same person, he replied that he thought he had spoken to two different people, because the person at the end was “less good at explaining and made more mistakes”.

When asked what he thought of the experiment as a whole, he commented:

The vocabulary was hard: not really the normal nouns (such as rechter Winkel), but rather the position verbs, such as stell es in Kontakt mit, oder die Sptize [sic] beruehrt...beruht auf.. Also understanding the other speaker’s instructions was not easy. Each one had to be read through many times. Giving the instructions was also difficult, that is, knowing where to start and how to explain it. It is obvious for the instructor because it is in front of our eyes, but one has to think about saying everything. The hardest parts are the small parts that hang in the air without touching any other piece because it’s hard to explain how far apart they are from the main figure. So it wasn’t easy but funny!
• Second pair

Speaker G-Sheet 2

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 2 and then Figure 1. He also thought he had improved at building, and had definitely improved at instructing (more than at building). Moreover, when asked if he thought he had always been talking to the same person, he replied that he thought he had spoken to different people.

When asked to comment on the experiment as a whole, he said that it was hard to explain what position to put the triangles in and further added the following:

The experiment was very interesting. I think that I got better with every new figure, especially my instructing improved. I always saw figures (house, rabbit, whale,...), my partner just once which didn’t made it easier for me. But there was also an improvement in our communication - we better knew what the other meant (I think :-). It was hard to describe to the other how the elements were ‘lying’ in the room...especially the paralellogram [sic] (if this is the correct name?) There was another problem in describing exactly how far the elements touched each other and we called it ‘...is half so long as...’. This is, in my opinion, not really correct described but we both knew what was said through it.

Surprisingly, Speaker G used the term ‘parallelogram’ in his comments, despite him not using it in the experiment (see discussion in Section 5.3.1, page 77).

Speaker E-Sheet 1

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 1 followed by Figure 2 and then Figure 5. He also thought he had improved both at building and at instructing. Moreover, when asked if he thought he had always been talking to the same person, he replied that he did.

When asked to comment on the experiment as a whole, he said:

I suppose the most difficult thing about it was saying exactly where the different shapes went in relation to each other. ‘Tilt it at
a thirty-degree angle to the left of the yellow parallelogram' isn’t the easiest thing to say in a foreign language when one is under time pressure. The shapes themselves were hard at first. I knew triangle was ‘Dreieck’, but didn’t know what gender it was - and since ‘Ecke’ is feminine, I found myself talking about something called ‘die Dreiecke’ until my German partner quietly mentioned ‘das Dreieck’, and I felt rather a fool! After that I picked up the proper names of the shapes fairly quickly, but saying where exactly to put them was hard. I remember especially the figure of the cat, I think that was number 5 on our sheet. That was the first shape I got which actually looked like something real, and we had the whole thing made apart from the tail. For some reason I simply could not get across [sic] how to make the tail. All that was in my head was ‘Look, we’ve made the wretched cat, now just put the tail on!’ forgetting that the tail, which I could see, was quite invisible to my partner; she didn’t know exactly where it went in relation to the cat’s body.

Here again, surprisingly, Speaker E used the term ‘parallelogram’ in his comments despite not using it in the experiment (see discussion in Section 5.3.1, page 77).

• Third pair

Speaker G-Sheet 1

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 1 and then Figure 3. He also thought he had not improved at building, but had improved at instructing. Moreover, when asked if he thought he had always been talking to the same person, he replied that he thought he had spoken to two different people.

When asking to comment on the experiment as a whole, he added:

Interesting idea, would be even more interesting to know what the sense of the experiment as a whole was. Instructing for me was more difficult than building, especially when I had ‘irregular’ shaped figures.

Indeed, Speaker G’s completeness and correctness rates were better when he was constructing than when he was instructing.
Speaker E-Sheet 2

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 3 and then Figure 1. He also was not sure whether he had improved at building, but hoped he had improved at instructing. Moreover, when asked if he thought he had always been talking to the same person, he replied: “No idea seemed like one person”.

- Fourth pair

Speaker G-Sheet 1

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 1 followed by Figure 5 and then Figure 3. When asked if he had improved at building, he replied: “No never! May be the candle but the time was up and we had computer difficulties.” However, he definitely thought he had improved at instructing. Moreover, when asked if he thought he had always been talking to the same person, he replied that he thought so.

When asked to further comment on the experiment as a whole, he added

When the german sentence structure is wrong you don’t understand anything. So I had always a hard time what is trying to say! Because of the structure in [his] sentences.

Speaker E-Sheet 2

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was definitely Figure 5 followed by Figure 3 and then Figure 1. He also thought he had improved at building, and when asked about improvement at instructing, he replied: “Yes, but I know [he] wasn’t understanding”. Moreover, when asked if he thought he had always been talking to the same person, he replied he did.

When asked to further comment on the experiment as a whole, he added “found it much easier to take instructions rather than to give them.”

Indeed, this is confirmed by the data which shows that Speaker E achieved better completeness and correctness rates as a constructor than as an instructor.
5.4.2 The Community Group Condition

- The English Native Speakers-Sheet 1

Participant 1E

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 1 and then Figure 3. When asked if he had improved at building and constructing, he replied that he did not think he had at either. When asked to comment on the experiment as a whole, he added:

I found it sometimes difficult to take the instructions as they were very unclear. I think if it had been clearer it might have been easier. [see success rates in Section 5.2.2, page 71]

Participant 2E

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 1 followed by Figure 5 and then Figure 3. When asked if he had improved at building, he replied he had. However, he did not think he had really improved at instructing. When asked to comment on the experiment as a whole, he added:

It was much more difficult to describe in German than receive English Instructions. With no 6 it was much easier the second time as we had done it already. It also became easier as you learned more vocab [sic] from the German participants.

Indeed, Participant 2E achieved very high degrees of completeness and correctness in the last two rounds, in which he was interacting with participants with whom he had already interacted. However, his comment that “It was much more difficult to describe in German than receive English Instructions” was not really reflected in the data, as he seemed to achieve rather high success rates throughout the rounds, whether he was an instructor or a constructor (see success rates in Section 5.2.2, page 71).

Participant 3E

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 1 and then Figure 3. When asked if he had improved at building and constructing,
he replied that he had at both, but specified for instructing: “Yes, gradually (fluctuating)”.

However this ‘fluctuation’ in his instructing capacity did not appear in the achieved performance degrees.

**Participant 4E**

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 3 followed by Figure 5 and then Figure 1. When asked if he had improved at building and constructing, he replied that he had at both.

- **The German Native Speakers-Sheet 2**

**Participant 5G**

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 3 and then Figure 1. When asked if he had improved at building and instructing, he replied “yes” to both. When asked to comment on the experiment as a whole, he added “number 5 was tricky.”

**Participant 6G** - did not submit questionnaire

**Participant 7G**

When asked which figures were harder to instruct, in order from hardest to easiest, he answered that the hardest was Figure 5 followed by Figure 3 and then Figure 1. When asked if he had improved at building, he replied that he maybe did but just “a little”. Concerning instructing, he answered: “Yes, definitely. After I knew the expressions in English”. When asked to comment on the experiment as a whole, he added “I think it was pretty difficult to explain the positions of the pieces. But at least now I know what a triangle is!”.

This clear improvement that Participant 7 noted as far as his instructing performance was concerned did not appear in the data. Indeed, in the rounds where he was an instructor, the achieved degree of correctness was always approximately 4 and the degree of completeness was constantly 5.
Participant 8G

When asked which figures were harder to instruct, in order from hardest to easiest, he also answered that the hardest was Figure 5 followed by Figure 3 and then Figure 1. When asked if he had improved at building, he replied that he thought so but just a bit. Concerning instructing, he did not think he had really improved. When asked to comment on the experiment as a whole, he added “although it would take quite long, a few more rounds would be nice.”

5.4.3 Comparison of the two conditions

In the monogamous pairs condition, the participants who had Sheet 2 all agreed on which figure was the hardest and which was the easiest. They were all sure they had improved at instructing, but somewhat uncertain about their progress at constructing. The participants with Sheet 1 did not agree quite as unanimously on a rating for the figures. They all thought they had definitely improved at instructing but only one out of the four participants felt he had improved at constructing. Regarding the comments they made, they all seemed to agree that instructing was harder than constructing, because it was hard to explain how to place the pieces and how to explain where they stood in relation to each other. Also, most added that giving figural-type descriptions helped support the instructions, and it was also mentioned that the task became easier once conversation partners had come to an agreement on the meaning of expressions used. Moreover, certain difficulties were due to the language restrictions: firstly, many had vocabulary problems at the start of the experiment, and then admitted that the task got somewhat easier once these had been overcome; furthermore, the language level of the instructors seems to have influenced the constructors’ performance in certain cases.

In the community group condition, it is once again the participants who had Sheet 2 who all agreed unanimously on a rating for the figures, the same rating as in the monogamous pairs condition. Most thought they had improved at instructing, and they all thought they had improved at constructing. However, the participants who had Sheet 1 did not meet such a clear consensus on a rating. Moreover, half of them did not feel any improvement at instructing, and all but one felt an improvement at constructing. As in the previous condition, they agreed that instructing was harder than constructing because it was difficult to explain the position of pieces, especially in a foreign language. Also, constructing seems to have been rendered difficult by instructions being unclear. However, it was also noted that the
task was easier when paired with a participant for the second time.

So, it emerged that all participants who had Sheet 2 agreed on which figure was hardest and which was easiest, contrary to those who had Sheet 1 where the opinions diverged quite a bit. Also, across both conditions, it was more widespread to feel improvement in instructing rather than improvement in constructing, despite participants from both experimental conditions agreeing that instructing was harder than constructing. Lastly, it often emerged that their performances at both instructing and constructing was disadvantaged by limitations in the foreign language.

5.5 Conclusion

In Section 5.2, I first analysed the performance of the task, looking at both completeness and correctness of construction, for participants from both experimental conditions. The differences found were minimal, pairs from the monogamous pairs condition being slightly better at correctness but slightly weaker at completeness than pairs from the community group condition. It must be noted though that these results were based on my own evaluation of correctness, which was naturally subjective. As a suggestion for future research, it may be interesting to carry out a test concerning reliability of judgments.

Then, in Section 5.3, I analysed the extent of convergence on expressions and description techniques between conversation partners, in both experimental conditions. Here again, there did not seem to be a clear-cut difference between both groups, except that participants from the community group obviously adopted conventions from various participants in the group, whereas participants from the monogamous pairs only adopted conventions from their fixed conversation partner. The differences seemed to be sooner due to attitude differences: participants could be either ‘convention introducers’, and not change their own language much throughout the experiment, or rather ‘convention adopters’, rendering their language in the final rounds quite different to that in the initial rounds, or both.

Lastly, in Section 5.4, I analysed the comments which I had collected from the various participants. Once again, whatever experimental condition they were involved in, they did not seem to greatly diverge, but rather all more or less agreed that they had improved more at instructing than at constructing, despite instructing being harder than constructing.

So, by simply looking at the results, it is hard to clearly differentiate the two experimental conditions, thus leading to the deeper analysis and discussion of the results in the following Chapter 6.
6 Discussion

6.1 Introduction

Following the detailed analysis (Section 5) carried out on the experimental data collected, I try to explain the results for both conditions, and tie these explanations in with the literature, also mentioning the effect of having a multi-lingual environment rather than a mono-lingual environment. I decide to focus on certain aspects of the results and explain them, each time contrasting the monogamous pair condition and the community group condition if there was a difference. In Section 6.2, I first look at the success rates in both conditions and suggest possible reasons for them. In Section 6.3, I then turn to the figural-type descriptions and their importance for the task. Next, in Section 6.4, I review a principle from the literature: the Input-Output Coordination Principle and look at how intensely it applies in my data. Then, in Section 6.5, I identify various participant behaviours and investigate what they are due to. Lastly, in Section 6.6, I review a second concept from the literature: grounding, and discuss its place in the task.

6.2 Success Rates

At a first glance at the performance results, no striking differences appear regarding the success rates between pairs in the community group and monogamous pairs. Concerning the completeness rate, one may think that, because, in the monogamous pairs, participants always interacted with the same partner, they should have spent less time at the start of the round coordinating and thus achieved a higher completeness rate. Yet this did not seem to be the case; rather, the pairs in the community group achieved a slightly higher completeness rate. However, this may simply be due to the fact that they were not affected by computer problems contrary to the monogamous pairs. Concerning the correctness rate, the monogamous pairs performed slightly better than the community group pairs, which one might have expected. However, it must not be inferred that always interacting with the same partner implies having less trouble coordinating on referring expressions. Even if this were the case, then the advantage of monogamous pairs clearly seems to be quite restricted, as their average correctness rate is only very slightly superior to that of the community group pairs (see Section 5.2, page 68, for exact results). So, on a whole, it is hard to draw conclusions.

5This point is further reinforced by the fact that the two monogamous pairs involved in the second experimental session who were more affected by computer problems than the first two pairs achieved even lower completeness rates.
from such results, mainly because the differences are so minimal that they can hardly be taken into account, and because they have numerous possible causes. Also, these ratings were assigned in a rather subjective manner, like any observation of performance typically is, and can therefore not be taken to be absolutely accurate.

Another recurring result was that the performance rates tended to decrease with time. This must not be automatically interpreted as an increasing lack of coordination; rather, external factors must be taken into consideration, such as the fact that the figures usually got harder with time, that computer problems multiplied with time, that participants may have been losing focus or felt more pressurised by time.

So, interpreting performance rates is not a clear cut issue. Similarly, interpreting convergence and coordination is very difficult and subjective too.

6.3 The importance of figural type descriptions

When observing the evolution of the conversations as a whole, it appears that pairs, in both conditions, typically started with very salient description techniques, sometimes starting by simply saying which pieces were ‘beside’ which others, or giving slightly more detail by giving ‘left/right/top/bottom’ information. For instance, Participant 3E from the community group started giving just ‘top/bottom’ information and then eventually realised, perhaps thanks to the Principle of Least Collaborative Effort, that ‘left/right’ information was important to minimize the collaborative effort. Then, participants progressively started depending on more figural type descriptions, or on a description scheme with cardinal points, rather than the vaguer ‘top/bottom’ instructions. However, this progression did not apply to all participants, as some started depending on figural type description schemes right from the start. Clearly, the fact that some participants did not see figural type descriptions as quickly or as often as others shows that they are less salient (or obvious) than the more ‘descriptive’ type descriptions (with ‘left/right/top/bottom’ information). For example, the English native speaker in the second monogamous pair, who had Sheet 1, only realised at the start of the last round that the figures looked like real-world objects or animals, when he said: “Diesmal habe ich sogar eine Form, eine Katze naemlich.” (=this time I even have a shape, a cat actually)

Yet, despite their ‘non-salience’, participants tended to make use of figural type descriptions, some in a very intensive and regular fashion. There are probably many possible reasons for this. One may be that figural type descriptions are briefer and more concise, thereby necessitating the use of
less terms than a more descriptive type description. Due to the multi-lingual environment (one of the novel aspects of this modified replication of prior research), and instructors having to instruct in their foreign language, this may have been an important factor. Moreover, a figural type description requires less coordination between the speakers than a more descriptive type of description. If one participant says it looks like a cat, or like a big square, or like a boat, then the other participant knows straight away approximately what general shape is being referred to, whether they have talked to each other before or not. Even an overhearer would understand just as well as the direct conversation partner an instruction saying that the figure looks like a boat or a T-shirt. Thus, such descriptions do not depend on having acquired a shared mental model specific to the two speakers; they simply depend on the two speakers having an approximately similar mental model of the world in general. On the other hand, imagine if an instructor, whilst trying to give the constructor a general image of the figure about to be built, said for example “The figure has the four triangles on one level with the square to the south of the small corner of the green triangle, and the other yellowish thing beside the lower side of the blue triangle.” Such an instruction can only be understood if the constructor has previously understood what the instructor meant by “small corner”, “on one level”, “the yellowish thing”, “beside” and “the lower side”. If these expressions have not been previously used and perfectly understood by the constructor, such an instruction would fail. So, such descriptive type instructions require a certain amount of coordination between the speakers and depend on them sharing a mental model, which is very specific to the task and to their dialogue. This may explain why they are less heavily used than figural type descriptions.

Giving figural type descriptions was not just a technique used at the start of the round, but also within the round, to support a more descriptive type instruction. So for example, the assembling of two triangles was referred to as a “bow-tie”. Similarly, to describe the position of a parallelogram or a square, certain participants realised that it was easier to say that it was placed like a “diamond” rather than saying that it was “on one point” and then for the parallelogram having to specify as well that it was “in a vertical position”. It is assumed that everyone knows what a diamond looks like, and that noone should have any difficulty placing a square so that it resembles a diamond, whether they have been talking to the instructor previously or have just arrived in the conversation. To use a term recurrent in the literature, ‘diamond’ is an expression which is already grounded: speakers have a clear notion of what it refers to, and this notion is common to everyone.

For the same reasons, to check whether a figure was being constructed correctly so far instructors often made use of a figural type description. In
many cases, a construction was completely wrong because the first piece had been misplaced, due to a misunderstanding of an instruction. Pairs usually realised when there was something wrong with the construction, and then got confused or anxious, and wasted valuable time trying to find the source of the error and repair it. So, especially in cases where part of the construction was possibly wrong, instructors preferred to give figural instructions such as “Now place the pink triangle so that it looks like a roof on top of the figure”, rather than say “Put the pink triangle on top of the green triangle”, because in the latter case, if the green triangle was misplaced, then the pink triangle would be so too, whereas in the former case, the chances are that the pink triangle would be correctly placed even if the rest was wrong. So, abstract figural type descriptions depended less on the rest of the construction being correct than more descriptive types, because they succeeded, whether or not speakers had previously successfully coordinated.

Moreover, one may also wonder whether giving such a figural type description actually helped the constructor to correct his construction so far if it was wrong. (So, in the case of the previous example, if his construction did not exactly resemble something which could have a roof, such as a house, but could if he turned one piece around, then he may do so) However, as there were too many constructions going on simultaneously, I only have photos of the final construction, so I can not tell whether a construction was correct from the start or was altered thanks to a helpful figural type instruction. With further resources (and time), it would be interesting to track the time course of construction completion (constructors may undo parts of their constructions prior to the end) and correctness (constructors might have the right idea and then lost it). Obviously, though, this would require more sophisticated equipment for recording data and for data analysis.

Even in the comments I gathered after the experiment, many seemed to agree that figural type descriptions helped, whether in the monogamous pairs condition or in the community group condition, especially if the instructions given were otherwise quite imprecise. In the community group condition, if participants did not come up with this technique themselves, their conversation partner usually would and, by the third or fourth round, they would have noticed its advantages and adopted it themselves. Also, for some participants, such as Participant 8G, giving figural type descriptions became so essential and conventionalised that if one was not given by the instructor at the start, it would be required.

Finally, although it appears that figural type descriptions helped and were very important to the task, stating that they were the only criterion determining final performance would be incorrect and incomplete. Another determining criterion was the amount of coordination between the partici-
The Input-Output Coordination Principle

In many cases, the constructor asked a question to the instructor using a particular expression or a description technique, specific to him, and the instructor then answered making use of that particular expression or description technique. So for example, in round 2:

(14) Participant 1E: “should the pink or blue be facing down?”
Participant 6G: “(...) the pink should be facing down”

This is clearly an instance of the Input-Output Coordination Principle: the instructor tuned his output to the input he received from the constructor.

The same occurred in the opposite direction: constructors tuned their output to the input they received from instructors:

(15) Participant 8G: “together they should resemble the legs and the back”
Participant 1E: “tell me about the head perhaps the legs will make more sense then”

As can be seen from the previous examples, this coordination may concern referring expressions, as in Example 14, or a particular description technique (such as using figural type descriptions), as in Example 15. This coordination is also an instance of the Principle of Least Collaborative Effort, as it is obviously easier to answer a question with the same terms as those in the question, than think up one’s own conventions, and it makes understanding for the conversation partner simpler, thus minimising the collaborative effort. One may even suggest that such types of clear coordination (or rather ‘copying’) should be more frequent in a multi-lingual environment than in a mono-lingual environment, as there will always be one of the conversation partners communicating in his foreign language, thereby typically unsure of his linguistic knowledge and tempted to just copy the native speaker’s formulations.

In the case of the monogamous pairs, I was able to see what had been typed and then deleted. Thus, I noticed that in certain cases, a participant started typing an expression and then deleted it, to type another expression instead, which had been previously used. This was the case in monogamous pair 1 where Speaker E started using the expression “90 Angle” to refer to the right angle. Then, when mentioning it again, he started typing “rechten” (=right) but then deleted it and typed “90Grad Angle”, so as to tie in with the expression used previously. This is a clear instance of a conscious application of the Input-Output Coordination Principle. It also seems
to demonstrate that participants did not act absolutely autonomously, but rather were aware of the other speaker, of what he understood and of what worked better for the task.

The principle also appeared distinctly in cases where vocabulary was unknown or only partially known. So, in many cases, the non-native speaker did not know the word for ‘triangle’ or ‘square’, or, in the case of German, knew the word but did not know the correct gender, the spelling or the ending. Then the native speaker made use of the word in question, in its correct form, in his own ‘speech’, without trying to explicitly correct the non-native speaker, and the non-native speaker then usually coordinated and adopted the correct word into his own speech, thereby tuning his output to the input received. Also, many participants did not know the word for ‘parallelogram’, and therefore used circumlocutions such as “the yellow thing”. The conversation partner then typically adopted the circumlocution; it remains unclear if they did this because they did not know the word themselves or because they considered coordinating with the partner more important than being perfectly accurate. The second reason is supported by situations such as the following:

Participant 2E: “ok, and the parallelogram?”
Participant 5G: “and finally you put the yellow thing onto that blue square, so that the whole picture looks like a burning torch”
Participant 2E: “is it just one of the corners of the yellow shape which is touching the blue square (...)?”

Here, Participant 2E knew the correct word for a parallelogram. However, on noticing that Participant 5G did not, Participant 2E decided to stop using it and use an expression more similar to Participant 5G’s one, to ensure he would understand, thereby carrying out the Input-Output Coordination Principle. Participant 5G, on the other hand, clearly did not apply the Input-Output Coordination Principle. This was perhaps due to the language ‘barrier’. He may have been so focused on the task and on finding adequate English formulations for what he wanted to say that he could not also pay attention to expressions used by the conversation partner.

This compromising accuracy for coordination occurred in many situations, especially in the community group condition. For example, in round 2, Participant 3E was matched with Participant 8G. Participant 3E did not seem to adopt any expressions introduced by Participant 8G, who, amongst other things, referred to the pink square as being “red”. Then, in round 3, Participant 3E was paired with Participant 5G. Both participants had, until then, always referred to the pink square as being “pink”. However, in this round, Participant 3E started referring to it as being the “rotes quadratt
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[sic] (=red square), because of Participant 8G having assigned it that colour in the previous round. Therefore, Participant 5G also stopped calling it by its correct colour, and started referring to it as the “rotes quadrat” to not confuse Participant 3E. So, the fact that it really was pink did not seem to matter compared to the importance of reaching mutual understanding with the conversation partner. Similarly, in certain cases, a participant introduced an expression which he believed was accurate but then if the conversation partner appeared to be put off by it, he would agree to change it and would simply conform to what the conversation partner wanted to call it. For example, in round 5, Participant 6G suddenly wanted to refer to the blue triangle as being “purple”, but on seeing that this confused Participant 1E, who wanted to refer to it as ‘blue’, he switched back to calling it “blue” too. Thus, in the interest of task performance and task success, Participant 6G coordinated with Participant 1E. Alternately, the monogamous pairs tended to agree right at the start on one referring expression and then, as they were always just talking to each other, they stuck to it, rather than change throughout the experiment.

The principle also seemed to apply across the rounds and across languages. So, for example, a constructor may have simply said “ok” throughout the round or simply demonstrated no sign of coordinating his output to the instructor’s input. Yet, in the next round, when the roles and the languages were switched and he became instructor, he may have started using expressions or description techniques, introduced in the previous round by the conversation partner. He was tuning his current output to input received in the previous round. These instances of the principle are less clear to identify because they involve not only re-using an expression introduced in the previous round, but also usually translating it. This translation issue is one big difference between having a mono-lingual environment and having a multi-lingual environment.

In some cases, such instances are still easily spotted: for example, in monogamous pair 4, the English native speaker introduced the notation “3angle” for a ‘triangle’, and the German native speaker then translated it to “3eck” (lit. “3corner”); similarly in monogamous pair 1, the English native speaker introduced the expression “90Grad Angle” to refer to the right angle when instructing, and the German native speaker then literally translated it to “90degree angle” when he became instructor. In other cases, it is much harder to determine whether a particular expression used by a participant was a translation of, or at least inspired by, an expression he received as input in a preceding round, or if it was his own ‘invention’ and only coincidentally resembled an expression introduced previously in the other language. This problem occurs also in cases when there was no language difference. Unless
the participants are explicitly asked, for each expression, the reason why they used it, it is impossible to say whether a speaker is using a certain expression because he received it previously as input, or whether he independently thought of it himself and did not even realise that it had been already introduced. Thus, most judgments of coordination and reuse of expressions were very subjective, especially in cases where translation was involved.

In the monogamous pair condition, the Input-Output Coordination principle seemed to systematically apply, despite the multi-lingual environment. This confirms what Garrod and Doherty (1994) found, that the convergence of isolated pairs depends entirely on the Input-Output Coordination Principle, which makes use of the processes of salience and precedence. On the other hand, in the community group condition, there appeared to be cases where the principle did not apply. Occasionally, conversation partners interacted for a whole round, without coordinating at all on their expressions. In some cases, this was clearly due to computer problems. These interrupted the conversation for an interval of a few minutes, thereby destabilising the participants, making them lose their concentration and forget the terms used by the conversation partner previously. However, even in certain rounds where no computer problem occurred, the Input-Output Coordination Principle seemed not to apply. So, for example, in round 3 of the community group condition, Participant 1E constantly referred to the right angle as the “spitze” (=point) whereas the conversation partner, Participant 7G, constantly referred to the right angle as the “obere spitze” (=top point). Similarly, whereas Participant 1E referred to the hypotenuse of the triangle as the “untere seite” (=bottom side) throughout the round, Participant 7G referred to it as the “laengste seite” (=longest side), as had been introduced in his previous round by Participant 4E. This lack of coordination clearly created confusion, as both speakers were not sure what was being referred to and hence it negatively influenced their performance. In the case of this conversation mentioned above, the degree of correctness achieved was 2. Also, in the community group, Participant 3E did not realise at first that the colours of the pieces were relevant, despite being both instructor and constructor with participants who had realised and who would always give or ask for colour information. It was only in Round 3 that Participant 8G explicitly pointed out to him that colours were important. So, in some cases the principle did not seem to apply, or at least not very strongly, and it is not quite clear what this was due to, and whether it was brought on (at least partially) by the multi-lingual environment.
6.5 Participants’ behaviours

One of the possible reasons of why the Input-Output Coordination Principle did not apply as strongly in some cases as in others may have been individual differences between participants. As constructors, some tended to just confirm each instruction by saying “ok” (such as Participant 3E) whereas others tended to interact much more, by asking questions, checking their understanding or making comments (such as Participant 7G). As instructors, some tended to take the lead and impose their own conventions (such as Participant 8G), whereas others tended to try using expressions introduced by their conversation partner (such as Participant 2E). The former attitudes may indicate that such participants were acting according to the “autonomous view” described in Section 2.4: they were not coordinating and simply carried out the instructions received. On the other hand, the latter attitude may indicate that such participants were acting more consistently with the “collaborative view”, described in Section 2.5, often adopting conventions from the instructors. These different attitudes may also have been influenced by the participant’s language level in his foreign language, though all participants did have an approximately equal language level. In this regard, Healey et al’s (2004) “mutual-modification view” could be reminded (see Section 2.6, page 31). According to him, the strength and amount of coordination between speakers depends on their being able to modify each other’s utterances; thus, imposing interaction constraints on a conversation would have an effect on the language used. Thus, it could be suggested that obliging the participants to instruct in their foreign language was such an interactional constraint; however, although this constraint clearly limited the complexity and idiomaticity of the expressions employed, it also led to a much richer language: speakers, who were not sure of their language ability, or who were not sure of the linguistic ability of their conversation partner, proposed many different formulations for the one intended meaning. (Note the multiple circumlocutions for the word ‘parallelogram’: “the yellow thing”, “the green thing which is not a triangle”, “the missing yellow part”, “the thing”, “the yellow piece with four corners”)

The two different ‘constructor attitudes’ may be explained by various possible reasons. In the case of the more autonomous attitude, maybe they were applying the Principle of Least Collaborative Effort, and felt that by simply confirming each instruction and thereby limiting interaction, they were minimising the collaborative effort (and helping the instructor who was struggling with the task of instructing in a foreign language); or maybe, they were people who absolutely wanted to impose their own conventions and refused to adopt any ones from other participants; or alternately, maybe it is simply
a trait of their personality to be less interactive. It must be noted however that such an attitude did not systematically imply poor performance. On the other hand, in the case of the more collaborative attitude, constructors asked questions, which served various functions: requiring more information on the placement of a certain piece (“is the parallelogram pointing east or west?”), clarifying a previous instruction (“the bottom right hand corner of the blue square touches the peak of the green triangle?”) or checking if a particular placement was correct (“so they are positioned exactly the same, one on top of the other”), and often adopted conventions from the instructors. This may have been due to them being perhaps more outgoing and interactive people, or to them thinking this was helping the instructor and his foreign language challenge, or alternately to them not minding changing their own language to adopt new conventions. Such an attitude however did not systematically yield high success rates. Also, there were participants who asked lots of questions, but nevertheless did not change their language (such as Participant 8G of the community group—for a transcript of his full conversations see Appendix M, pages 188 onwards). On the contrary, they hoped to make the instructor adopt their expressions and description techniques, thanks to numerous and specific questions. They perhaps felt that by imposing their conventions, they would make future collaboration much easier and coordination stronger. It must be noted that this Participant 8G did achieve an average degree of correctness of 5 as a constructor, indicating that such an attitude would seem to lead to success in the task.

Moreover, it must be noted that, in some cases, a constructor said “ok” to an instruction though he actually had not understood the instruction. It is not clear whether they did this consciously, because they did not want to coordinate, or were too lazy to ask for more details to ensure they were correct or even because they were anxious about time running out or about embarrassing themselves. Alternatively, perhaps they felt that they had understood the instruction sufficiently to place the piece in question correctly. Possibly, they may even have thought that they had understood the instruction perfectly and effectively shared a task-specific mental model with the instructor. Such an attitude clearly led to a low success rate. In other cases, they rather said “OK I think” or “I think I follow”, which may have indicated that they realised their understanding was not complete but considered it sufficient for the purpose of the task. If, on the other hand, a constructor did ask a question to get more information but the question was not answered by the instructor, he then usually simply ‘guessed’ the placement of the piece, or at least made do with the information at hand. Thus, there appeared to only be a certain time frame within which a constructor was willing to interact and collaborate; after that, he gave up. The length of this
time frame may possibly be determined by the time allowed for the task, or by the specific personality of the constructor.

There were also two different ‘instructor attitudes’. Certain participants tended to keep using expressions and techniques which they introduced themselves, and may therefore be referred to as ‘convention introducers’ whereas others changed their ‘language’ and started using expressions introduced by the current or former conversation partner(s). These may be referred to as ‘convention adopters’. As aforementioned, the former may be considered to act according to the “autonomous view” of inter-speaker coordination, whereas the latter would act according to the “collaborative view” of inter-speaker coordination. Here again, there did not seem to be one attitude which clearly led to high performance, and another clearly to low performance; coordination and success depended on the attitude of both conversation partners and how they interacted.

In the monogamous pairs, it was generally the case that each participant had one clearly assigned role in the task: one participant imposed his conventions, be it as an instructor or as a constructor, whereas the other would let his partner lead and simply adopted the conventions so as to facilitate coordination. These roles were taken on naturally, without explicit negotiation. Perhaps, they unconsciously established at the start whose language skills were better and assigned the roles accordingly. Or perhaps this was due to the fact that in real life, certain people are predisposed to impose whereas others just let the others impose. Regarding the importance of foreign language level, it must be noted that, in the monogamous pairs, the rounds where the German native speakers were instructing, thereby communicating in their foreign language, were on average longer than those where the English native speakers were using their foreign language; this may be due to the German native speakers’ English being better than the English native speakers’ German. So, in this regard, it may perhaps have been an idea to add a language ability pre-test; however, this would have been hard to design as language ability is such a general term with many different components. The problem with the aforementioned clear-cut role assignment between conversation partners is that the amount and strength of coordination that takes place is very dependent on the respective behaviours of the two conversation partners involved, on their foreign language level and on their willingness to interact. One instance of the problem that this might create was made more apparent by the multi-lingual environment. Instructors always instructed in their foreign language and thus depended on the constructor’s utterances to pick up the correct form of words they were not sure of. However, if the constructor constantly simply said “ok”, this ‘picking up’ did not take place. So, for instance, the English native speaker in monogamous pair 4 thought the
German word for triangle ("Dreieck") was feminine, rather than neutral, all through the experiment, because his partner never interacted with him in the rounds which took place in German. More generally, if one speaker tends to never interact much, then his conversation partner will never know whether or not an expression or technique has been adopted, and will therefore be hesitant about re-using it, thus making coordination less strong.

On the other hand, in the community group, where participants changed conversation partner with each new round, they were not assigned a role which was to hold throughout the whole experiment. When the constructors became instructors, some started behaving very differently. For instance, certain constructors who appeared to not adopt any conventions from the instructor and act very ‘autonomously’ suddenly started adopting numerous conventions from their conversation partner, thereby acting in a very ‘collaborative’ manner, such as was the case of Participant 5G. So within the same experiment, the same participant could, in one role, not adopt any (or many) conventions and, in the other role, adopt many. This tends to suggest, that, whether or not a participant adopted conventions from other speakers did not depend on how outgoing or reserved he was, or on his own foreign language skills, but rather on his current ‘role’ or/and on his current conversation partner. This is further supported by the fact that for certain participants, it was the rounds where they were interacting in their foreign language which were longer (in terms of number of words), whereas for other participants it was the rounds where they were using their native language which were longer; no clear pattern seemed to emerge in this respect. Moreover, in some cases, even within the same role, participants seemed to change their behaviour throughout the rounds: a participant may have started off being very minimalist in his answers as a constructor, but then progressively became a more interactive constructor, such as Participant 1E in the community group. It is hard to determine a unique reason for this. Possibly, the participant realised that interacting helped their performance in the task; possibly he decided that his instructors were not being interactive enough so he had to get more involved as a constructor; or alternately, he perhaps just became more comfortable and felt more able to interact. Others evolved the other way. They started asking lots of questions and being very interactive constructors in the first rounds and then progressively became more and more minimalist. This may have been due to them feeling that saying “ok” helped achieve better performance, taking into account the current instructors; or to them noticing that time was a problem and that by simply saying “ok”, they were limiting the collaborative effort (Principle of Least Collaborative Effort), thereby saving time. For example, it emerged that often, at the end of rounds, when the time limit was approaching, constructors
tended to act more autonomously, just wanting the next instruction whether or not they had understood the previous one. (On the other hand, certain constructors continued acting just as collaboratively, constantly making sure that everything so far was correct. This difference may reflect different attitudes of people in the world in general; some are more thorough than others.) Furthermore, if one participant tended, as a constructor, to stop asking questions and just said “ok” instead, the conversation partner tended to proceed similarly when constructing. Thus, despite the fact that they were both switching to more “autonomous” behaviours and thus becoming less “collaborative”, they were clearly demonstrating coordination by acting similarly to one another.

Yet other constructors from the community group were willing to adopt certain conventions but not others. For instance, Participant 5G would let the instructor know if he liked one of his expressions or techniques (note comments such as “danke. sehr gute info” (=thankyou. very good info)), thereby encouraging him to use it again in future. However, if he did not like a particular expression or technique, and possibly felt that using it in the future would not contribute to minimising the collaborative effort, he would also make this clear to the instructor, and would try to impose his version of the expression or the technique. This may possibly have been linked to the incorrectness of the presented convention (as it was uttered in the instructor’s foreign language).

Another possible factor explaining why participants of the community group changed roles throughout the experiment, contrary to the monogamous pairs, may be linked to the type of instructor they were matched with. Some instructors were very clear and precise in their instructions; in such cases, there was no need for the constructor to ask questions, he had all the necessary information. No need for interaction tended to imply no need for coordination and adoption of one another’s expressions. So maybe coordination was only necessary if all the necessary information was not being provided by the conversation partner and one had to contribute to the conversation. Other instructors, on the other hand, were quite vague, such as Speaker G in the first monogamous pair who simply says to place the parallelogram “from down left to high right” (see Figure 25, page 80). This, of course, was maybe done on purpose to save time; or perhaps such participants believed that it was easier to leave coordination happen naturally thanks to the Input-Output Coordination Principle, rather than give very precise instructions. Whatever the reason, it meant that the constructor was forced to interact, ask questions and, typically, ultimately take the lead. This is equivalent to saying that such an attitude made the constructor entirely responsible for the success (or non-success) of the task, instead of both con-
versation partners sharing this responsibility. In the monogamous pairs, this changing and adapting of behaviour was not an issue as partnerships were fixed; however, in the community group, this process had to be repeated at the start of every round, in view of ‘choosing’ an ‘introducer’ and an ‘adopter’.

Moreover, as in the case of constructors, instructors from the community group may change their behaviour throughout the experiment. So, certain instructors may start off being ‘convention adopters’ but then progressively stop adopting new conventions and either just reuse expressions which they had previously adopted or become ‘convention introducers’. This is possibly due to the fact that they felt they had enough referring expressions in common with their conversation partner for the task to be successful. Alternately, they may simply have felt lazy or pressurised by time, and thought that by not adopting any more conventions, they were simplifying or shortening the task. Alternately, some instructors, such as Participant 3E, progressively adopted more and more expressions to become ‘convention adopters’. As aforementioned, maybe they considered this the key to success. It may also have been the case that such an evolution was completely unconscious and was simply due to the Input-Output Coordination Principle acting more and more strongly. However, Participant 3E changing his ‘instructing’ attitude in such a way did not seem to significantly affect the success rate of rounds where he instructed. This may further indicate that success rates clearly do not only depend on the behaviour of one of the conversation partners, but rather on that of both, and on how these two ‘match’ (and ultimately hopefully ‘coordinate’).

As mentioned previously, most participants behaved differently as an instructor and as a constructor. Others behaved quite similarly in both roles. For instance, Participant 3E in the community group only adopted very few expressions both as an instructor (at the start anyway) and as a constructor: in the former role, he would try to impose his own conventions, leaving little space for interaction, and in the latter role, he would simply say “ok”, except if very confused. Such an attitude, in his case, did not seem to yield particularly high or low success rates, but rather an average of 3.5 as an instructor, and one of 4 as a constructor (see Section 5.2, page 68, for a full listing of success rates and averages). However, when interpreting his behaviour, especially that as a constructor, it must be taken into account that he was instructed twice by Participant 8G, who was so complete in his instructions that there was no real need for interaction. Moreover, it appeared that the few conventions that he did adopt were ones introduced either by Participant 7G or Participant 8G. Similarly, Participant 4E who was a clear ‘convention introducer’ took the few conventions he did adopt from participants 7G and
8G. Why did they adopt conventions from these two participants in particular? Maybe participants 7G and 8G made use of better conventions, or at least conventions which were considered to be the key to success. However, contrary to the case of the monogamous pairs, where it negatively influenced the amount of coordination in the task as a whole if one participant took on the role of the ‘non-interactor’ and kept to it for the whole experiment, this was not such a problem in the community group. The pairings alternated at each round; hence, if a participant was matched with a partner who did not interact, it was only this particular round which may have been affected by a lack of coordination, and not the whole task. For the next round, he was assigned a new partner and the amount of coordination may suddenly increase, and thereby usually also the performance level. Thus, in the community group condition, it was not quite as important whether participants interacted or not as constructors, because with each new pairing they had the possibility of altering their behaviour.

In sum, there are clear individual differences in response to the role of being an instructor or constructor, interacting with external personality differences and linguistic knowledge that do not vary directly with the main factors of monogamy and polygamy.

### 6.6 Grounding

Grounding is defined in the literature as a process through which speakers achieve mutual understanding (Traum & Allen, 1992), thanks to information entering into the common ground throughout the conversation (Traum & Dillenbourg, 1998).

In the experiment, this could occur explicitly, whether participants were from the monogamous pairs or the community group. So, for example, Participant 6G and Participant 4E could not agree on which piece was to be referred to as ‘yellow’ between the beige and yellow one, and so they explicitly decided to call the beige one “hautgefarbt” (=skin-coloured) and the yellow one “richtig gelb” (=really yellow). Thus, these two expressions entered into both participants’ common grounds. Other explicit cases of grounding include situations where the non-native speaker was unsure of a word or was at a loss for a particular word and asked the native speaker for help, such as the English native speaker of the third monogamous pair asking the German native speaker “wie sagt man ‘candle’ nochmal?” (=how do you say ‘candle’ again?) Then, the native speaker’s answer was grounded and could further be used a referring expression as they both knew that the other knew what the word meant. Such occurrences of explicit grounding were possibly more frequent in a multi-lingual environment than in a mono-lingual environment,
where all participants would be using their native language. However, in most cases, grounding took place implicitly, despite the ‘language barrier’. Both participants, regardless of their group (monogamous pairs or community group) simply came to an agreement on a certain expression without ever explicitly saying so. This was usually consistent with the aforementioned Input-Output Coordination Principle, whereby a participant uses expressions and techniques received as input in his output. In most cases, the reused expression was then grounded, meaning it became part of their common ground. A clear example of this was when a non-native speaker did not know a word or its correct form, and without explicitly asking the native speaker for help, suddenly acquired it or corrected himself, simply because the native speaker used the word in his own ‘speech’. From then on, the correct form had entered into the common ground and was used throughout the experiment. Obviously, if the native speaker was someone who tended to limit interaction by simply saying “ok”, the correct form of the word may never be uttered, thereby seemingly disallowing its grounding.

So, constructors who tended to limit interaction by constantly saying “ok” would seem to also have limited the extent of grounding. Perhaps, they said “ok” because they felt that they had already ‘grounded’ enough for the purpose of the task, and that their common ground was sufficient for success. Yet, when such a constructor, whether member of the monogamous pairs or of the community group, then became instructor, he suddenly made use of expressions which he had received as input in the previous round, usually translated into his foreign language. So, although he constantly said “ok” or seemed to refuse any collaboration or coordination by keeping to his own conventions, he still adopted certain expressions, possible unconsciously. This would tend to suggest that despite him showing no apparent signs of coordination, certain expressions nevertheless were grounded, which explains their subsequent re-use.

There are many other facts that support the idea of grounding. Clearly, the more specific the expression, the more straightforward the grounding: an expression such as “90 Grad Winkel” (=90 degree angle) for the right angle is easier and quicker to coordinate on and to ground than an expression such as “the small corner” to refer to the right angle. Yet, even such ‘illogical’ expressions as the latter (the right angle is actually the biggest angle of the triangle) seemed to not cause any confusion. This must imply that they had been previously grounded and were, thus, part of a shared common ground between the conversation partners, whereby both knew exactly what the expression referred to. If a third person joined the conversation in the middle, he would probably not have known what corner the “small corner” referred to, and would possibly have opted for one of the 45 degree corners. Also, cer-
tain participants simply referred to the right angle as the “corner”, and their conversation partner still knew which corner was being referred to. This is also a sign that the expression “corner” was in their shared common ground where it denoted “right angle”. A third person joining the conversation would probably not immediately have assumed that “the corner” referred to the right angle. This refers to the paper by Schober and Clark (1989), which discussed whether overhearers were at a disadvantage compared to an active member of a conversation with respect to comprehension (for further discussion, see Section 2.4, page 27). This apparent importance of grounding was further reflected by the fact that if an instructor used a rather vague expression such as “a short side of the triangle” for the first time, and the constructor did not ask for more information, then he would usually misplace it, because he did not know what the expression referred to exactly: it was not grounded. Such a situation occurred in Round 5 and the degree of correctness achieved was 2, which tends to support the importance of grounding. Even if the constructor did ask a question but it was not answered by the instructor, the former would guess the placement and usually misplace it, thereby disallowing its grounding. Thus, it appears that there was only a certain timelapse within which grounding may occur. Once it had elapsed, speakers seemed to give up their attempt to ground it. A further ‘unclear’ expression which was used consisted in referring to the parallelogram as “the yellow thing”, such as the second monogamous pair did. The triangle was also yellow; yet, the conversation partner did not seem to have any trouble understanding that the expression referred to the parallelogram. This may imply that the expression was grounded, thereby rendering its denotation clear to both conversation partners. However, it may also be the case that its denotation was simply inferred from the fact that if the triangle had been meant then the word “triangle” would have been explicitly used. Thus, because the speaker used the word “thing”, the conversation partner inferred that he was referring to the more ‘obscure’ shape: the parallelogram. Therefore, understanding such an expression does not always seem to depend on grounding occurring.

Another sign of grounding is that certain participants’ ‘languages’ changed between the first and the last round, regardless of whether they were members of the monogamous pairs or of the community group. By the last round, they made use of a whole new set of expressions and description techniques rather than those they used at the start. Clearly, conventions had entered their common ground, which changed with time. This tendency to change one’s own language may have been emphasised by the multi-lingual environment; speakers of a foreign language usually take on native speaker’s expressions, rather than maintain their own ‘foreign talk’ expressions which are probably
less accurate and pertinent.

However, there are other situations where grounding clearly did not seem to take place, be it in the monogamous pairs experimental condition or the community group experimental condition, and this was the source of misunderstandings. Sometimes, grounding did finally occur, but only thanks to explicit negotiation between the conversation partners. For example, in the third monogamous pair, the German native speaker (Speaker G) referred from the first round onwards to a certain “normal position” of the triangle (see Figure 26, page 82). However, the English native speaker (Speaker E) did not understand what this position referred to. This can be seen through the confusion and misplacements caused by instructions containing this “normal position” concept, and by the fact that Speaker E never made use of this concept in his own speech, but rather tried introducing his own way of referring to a triangle. However, he did not say he had not understood it, so the German native speaker felt his expression had been perfectly understood and made extensive use of it, while the English native speaker still did not know what this position meant. So, clearly, this expression did not successfully become part of their shared common knowledge, nor did both participants share a common model of the expression. Therefore, there were misunderstandings all through the experiment. It was only in the last round, thanks to explicit negotiation, that the confusion was cleared up: the English native speaker made it clear to the German native speaker that he did not know what the “normal position” referred to and the German native speaker explained it again. Finally, the expression was grounded. However, the surprising fact remained that, despite this pair having this “normal position” referral problem until the last round and being affected by numerous computer problems, they still performed very well, which perhaps suggests that coordination and grounding were not actually that essential to success.

So it would appear at first that, as far as grounding, or non-grounding respectively, was concerned, the experimental conditions did not make any difference: whether part of a monogamous pair or of the community group, participants all seemed to behave similarly with respect to grounding. Certain expressions entered the shared common ground, others did not. Also, the fact that the environment was multi-lingual rather than mono-lingual did not seem to make a difference: the non-grounding of an expression such as “normal position” does not appear to be linked to it originating from a German native speaker.

Yet, on closer analysis of the grounding process, cases emerged which made the community group condition different to the monogamous pairs condition. In the monogamous pairs data, as mentioned previously, an expression was clearly either grounded or else non-grounded. On the other
hand, in the community group data, there were cases where an expression appeared to be grounded, but then suddenly caused confusion. A reason for this may have been that the use of the foreign language made participants more unsure of their use and understanding of terminology. So, for example, in round 3, both participants 3 and 5 referred to the right angle as the “spitze” (=point) and both were clear about the denotation of the expression. It appeared to be grounded, to be part of their shared common ground. Yet, half way through the round, Participant 3E gave another instruction involving the term “spitze” and, suddenly Participant 5G had a doubt about which point of the triangle this expression referred to and asked “die ecke die zwischen den kurzen seiten liegt?” (=the corner that lies between the short sides) So, the expression seemed to suddenly no longer be grounded, thereby yielding many questions: Was it ever grounded? Or can expressions suddenly become ‘un-grounded’, disappearing from the common ground? How permanent is grounding? Similarly, in round 4, Participant 6G used the term “point” to refer to the right angle in his instructions. The conversation partner, Participant 3E, coordinated on this terminology, understanding that it referred to the right angle: the term appeared to be part of their shared common ground. Yet, Participant 6G then started using the term “point” to refer to other corners of the triangle, thereby confusing Participant 3E. It is unclear whether this was done consciously or not, whether Participant 6G simply was lazy and thought that Participant 3E would understand. It also once again rises the question as to whether grounding is fictional, or not. Moreover, the aforementioned fact that certain participants from the community group started considering the “pink” triangle to be “pink”, then, after talking to someone who considered it “red”, started referring to it as “red”, and finally after talking to someone who considered it “pink”, switched back to his previous terminology must be reminded. Did he actually change his own conception of the colour or was he just trying to coordinate? What happened to grounding? Did the term “pink” initially enter the common ground, and then in the next round, disappear from the common ground and is replaced by “red”, and was subsequently replaced again by the term “pink”? Or, perhaps, once again, one might conclude that grounding is fictional?

There were also participants from the community group who seemed to use terms to denote two different things. This seemed to be due to the multi-lingual environment. So, for example, Participant 7G, a German native speaker, used the English word “edge” to refer to a ‘point’ or to a ‘side’ of a triangle in his instructions, depending on the context, whereas his conversation partners, who would all have been English native speakers, knew that the “edge” of a triangle means the ‘side’ of a triangle. Yet, they did not seem to be disturbed by this double use of the word. It appears as if
in Participant 7G’s mental model “edge” had two meanings, whereas in the English native speaker’s mental model “edge” only had one meaning. Yet, grounding implies the formation of a common ground. What would enter into this common ground? The two denotations of “edge” or just the correct one? If the two entered into the common ground, then the English native speakers should also have started using the word “edge” to refer to the point of a triangle; yet they did not. Another possibility is that the term was not grounded at all, if grounding were just a fictional concept.

Such observations are specific to the community group data; in the monogamous pairs, once an expression was grounded, it remained grounded, and if it was not grounded, it remained non-grounded. This refers to what the literature says about mono-lingual environments, in which the language of monogamous pairs is more stable at the start than that of the community group (Garrod & Doherty, 1994). It may perhaps be concluded that one can only talk about grounding when considering monogamous pairs. When considering the community group condition, grounding possibly seems to become a fictional concept which does not rightly apply. Yet, the performance in the latter condition was not significantly inferior to that in the former condition, which suggests that performance did not depend uniquely on grounding, and that some other mechanism was at play in the community group condition. This once again ties in with what the literature says about language coordination in a mono-lingual environment: In a community group, pairs of players are less coordinated in the early games than the isolated pairs were. It clearly takes longer in this situation for a common language, and hence a common description scheme to appear. The reason for this is that the group has to first establish a community-wide convention between all its members. Only once this is done, can they all act according to this convention, and coordinate as a group. Finally their convergence is much stronger and their language is much more stable than it is at the end of the task for the isolated pairs, despite their encountering a fresh new partner at each new game (Garrod & Doherty, 1994). According to this, if the experiment had involved more rounds, a community-wide convention would have been established: the participants would have stopped altering their expressions so often and would have become very strongly coordinated and successful in the last rounds. So, the fact that the success rates (see Section 5.2) were quite similar between the two conditions might have been simply due to the fact that the experiment did not last long enough for this community-wide convention to establish itself.

I mentioned previously on page 91 the striking resemblance between Participant 1E and Participant 4E’s instructing of Figure 1 (Sheet 1) in round 5. They proceeded very similarly, using the same expressions, and giving the
same figural type descriptions, despite them never having directly communicated with one another, as they were both English native speakers. Without any direct contact, they apparently had coordinated. Of course, this could simply have been coincidental or due to the fact that such a description was perhaps the most salient one, but if this were the case, then the two other English native speakers would also have described the figure in the same way, which was not the case. So, even in this multi-lingual environment, there does seem to be a first sign of a community-wide convention establishing itself, just as literature for a mono-lingual environment had suggested.

6.7 Conclusion

On the whole, in this chapter, I focused on certain parts of the data underlined in the previous analysis chapter (Chapter 5), examined whether there were differences between the two experimental conditions and suggested possible interpretations. I also investigated the effects caused by having a multi-lingual environment, rather than a mono-lingual environment.

Task performance (Section 6.2) did not appear to be a determining factor in differentiating the two conditions. On average, both participants from the monogamous pairs and those from the community group achieved approximately similar completeness and correctness rates. Moreover, the multi-lingual factor obviously occasionally slightly slowed down the instruction and construction process, but not to a significant extent.

The use of figural descriptions (Section 6.3) also seemed to be quite similar in both conditions, as all the participants, regardless of their condition, appreciated their importance and after three or four rounds at the most, made use of them. Moreover, the fact that the environment was multi-lingual rather than mono-lingual did not seem to have any striking effect.

The Input-Output Coordination Principle (Section 6.4) applied to both conditions, across the rounds and languages; yet, it did so to a different extent: the monogamous pairs appeared to be more systematically influenced by the principle, typically coordinating early on in the experiment on expressions and then keeping to them; alternatively, the pairs from the community group tended to alter their expressions throughout the experiment and in some cases appeared to not coordinate at all. Moreover, the multi-lingual environment obviously had certain effects on the dialogue and on coordination. Firstly, foreign language limitations made certain instances of input-output coordination more obvious. Also, in some cases, if the instructor was unsure of a certain expression, he copied the native speaker’s expressions, thereby strengthening coordination; however in other cases, he seemed too preoccupied with overcoming the difficulties posed by the language factor that he
was not receptive to the input from the native speaker. So, despite there being certain effects brought on by this multi-lingual environment, no general conclusions can be drawn from them; they are simply effects due to the additional foreign language factor, not to a completely different coordination process.

Studying participants behaviours (Section 6.5) was also quite revealing. Certain seemed to be more interactive than others, more ready to adopt new conventions and less intent on imposing their own ones, thus encouraging coordination. Such differences may have been partially caused by their respective foreign language skills. In the monogamous pairs, participants tended to adopt one attitude and act accordingly throughout the experiment, whereas in the community group condition, participants frequently changed their attitude throughout the experiment. However, it must also be taken into account that in the monogamous pairs, the participants knew the language level of their conversation partner, thereby taking on a fixed role right from the start, without any need for adaptation at the start of each round. On the other hand, in the community group, participants were confronted with a new partner at each round for whom they did not know the language level. So, here again, the fact that the environment was multi-lingual and that there were always certain participants communicating in their foreign language, affected the dialogue, especially in the community group condition: in an environment where all participants would be using their native language, individual behaviours would not be based at all on language level. Also, there would naturally be less language level differences between participants and therefore less adaptation required at the start of every new round. However, these differences were to be expected, considering the context. They do not imply that the process of linguistic coordination is fundamentally different in a multi-lingual environment, to that in a mono-lingual environment.

Lastly, grounding (Section 6.6), at a first glance, seemed to take place in both experimental conditions, and be the key to coordination. However, on a closer analysis, though it remained clear that grounding occurred in the monogamous pair condition, a doubt was raised about the community group condition. In the latter, a community-wide convention was perhaps at play, ultimately making the coordination much stronger and more stable than in the monogamous pairs condition. Of course, here again, there were certain small differences due to the multi-linguality of the environment; for instance, in certain cases, grounding seemed to be negatively influenced by participants’ restricted language levels. But then, in other cases, it seemed rather positively influenced by their language level, because certain non-native speakers were more willing to ground expressions from the native speaker than keep to their ‘foreigner talk’ expressions. So, as previously
mentioned, the effects of the multi-lingual environment seemed to be rather participant-specific and quite minimal. No general trend seemed to emerge which would clearly differentiate coordination in a multi-lingual environment to that in a mono-lingual environment. Rather, on the whole, grounding seemed to take place just as in a mono-lingual environment and even did not seem to be affected by the communication language changing at each round. So, the results from my experiment seem to tie in fully with those from mono-lingual experiments in the literature: in both cases, the monogamous pairs start off being more coordinated but the community group pairs then ‘catch up’, thanks to a community-wide convention establishing itself. Whether speakers are communicating in their native language or in their foreign language does not seem to make any significant difference; they still coordinate in a similar fashion.

These results can be extended to real-world situations. Coordination is at play (and necessary) in most activities such as political discourse, treaties or commercial exchanges. In such situations, the participants involved all coordinate on terminology and finally converge on a common language. Clearly, it is in cases where this coordination is unsuccessful and where speakers use similar expressions but with different denotations, that problems and communication breakdowns occur. This reinforces the absolute necessity for linguistic coordination. Also, the fact that speakers coordinate similarly whether they are all communicating in their native language or whether certain are using a foreign language is vital to the discussion, as in today’s world, negotiations in mono-lingual environments are becoming less and less current, compared to those taking place in multi-lingual environments.
7 Conclusion

7.1 Achievements

In this thesis, I have investigated the phenomenon of linguistic coordination between speakers in two different experimental conditions, and, most importantly, in a multi-lingual environment, rather than a mono-lingual environment. This represents an advance in the study of multi-lingual communication and coordination. I have gained an insight into how people formulate and process language, be it their native language or their second language. I have also become conscious of how unstable mutual comprehension can be, despite it being typically taken for granted that conversation partners necessarily understand each other. Moreover, I have obtained a better view of the different attitudes that speakers tend to adopt in conversation, and have suggested possible reasons for these.

In Section 7.2, I provide an overview of the main conclusions I drew from my data and highlight the contribution made to the literature by setting a multi-lingual environment. Then, in Section 7.3, I list possible ideas for further research in the area, which I could not carry out due to lack of time and resources. Lastly, in Section 7.4, I conclude this chapter and this project with a few closing remarks.

7.2 Summary of main conclusions and contribution to the literature

The main conclusions I drew from my data were for the most part consistent with those stated in the literature for mono-lingual environments. Firstly, figural type descriptions proved to be very important, and they even gained in importance as dialogue went on. I suggested this being due to them requiring a lesser degree of inter-speaker coordination (see Section 6.3). Secondly, there were many different participant behaviours which emerged, certain quite autonomous while others rather interactive. These probably emerged from a combination of individual personality, language ability as well as an adaptation to the current conversation partner’s behaviour. People involved in a conversation typically seem to rapidly come to an implicit agreement as to who is going to lead (see Section 6.5). Thirdly, the contrast between coordination in the two experimental conditions: the ‘monogamous pairs’ condition and the ‘community group’ condition, which is discussed at length in the literature with regards to a mono-lingual environment, was also to be found in my data. Monogamous pairs acted fully consistently with the Input-Output Coordination Principle. This rendered their language more stable at the start
and their coordination stronger. On the other hand, in the community group situation, a community-wide convention must first be established. Until this was done, their coordination was quite unstable, as the Input-Output Coordination Principle did not seem to apply systematically and grounding did not always take place. However, once the convention is established, and in my data it seems to start becoming apparent in the last rounds, their language is more stable and their coordination much stronger (see Section 6.4 for further discussion concerning the Input-Output Coordination Principle and Section 6.6 for further discussion concerning grounding).

This leads to what I feel is a contribution made by this thesis to the literature. The environment, be it mono-lingual or multi-lingual, does not seem to make any difference where linguistic coordination is concerned. Obviously, there are certain differences between a ‘native speaker’ dialogue and a ‘native speaker with language learner’ dialogue, but these are simply linked to language limitations and do not influence the core principles of coordination. Whether speakers are communicating in their native language or their foreign language, phenomena such as the Input-Output Coordination Principle and grounding occur in a similar fashion. Collaboration plays an equally important role and in both cases, speakers finally converge on a common sub-language. In a world where multi-lingual environments are more and more the norm, I consider this contribution quite important.

7.3 Further research

With more time and resources at hand, a lot more research could have been carried out. Clearly, the experimental sessions could have lasted longer, so as to really observe the emergence and establishment of a community-wide convention in the community group. Also, as mentioned in the thesis, the construction process could have been filmed to study exactly how constructors processed instructions, timing stages of construction with respect to sequences of utterances. Moreover, participants’ second language ability could have been tested at the start. Another interesting test could have been designed to evaluate reliability of personal judgements. Furthermore, an experiment exactly like the ultimate one in this thesis but set in a mono-lingual environment could have been carried out, thereby rendering comparisons between results in the two environments even more accurate and reliable.

These findings could also be a base for further study into second language learning. Is it more advantageous when learning a language to always interact with the same native speaker or to interact with many different native speakers? According to the aforementioned conclusions, the latter should prove more helpful and lead to a more significant improvement in the for-
eign language, because the learner will eventually coordinate his language more strongly with the native speakers’ language. Moreover, the question of whether second language learners can learn and improve through conversations in the foreign language with other non-native speakers could be investigated thanks to an experiment just like the ultimate one described here but involving only learners of the same language interacting in this second language. If it arose that in the instruction/construction process, the second language learners collaborated so as to achieve correct formulations, and then both coordinated on this correct version, this would shed a light on the advantages for a language learner of interacting with other language learners.

It may also perhaps be interesting to investigate whether the form of communication: oral versus written influences coordination. The ultimate experiment presented here could have been carried out but with people talking orally to each other, and the results then compared with those which emerged in this case from written communication. Such findings indicating whether strength, extent and form of coordination differ with the type of communication at hand could also prove useful for second language learning research. It may be the case that computer programs permitting instant communication contribute significantly to language learning as they combine the advantages of writing and reading with those of speaking and listening.

### 7.4 Concluding Remarks

Linguistic coordination is an absolutely essential and omnipresent component of everyday life and, yet, only few are conscious of it. I am glad to have gained a deeper insight into it, and from now on will be conscious of converging on a common sublanguage with my interlocutor, when trying to make conversation more efficient!

Moreover, I liked the experimental side of my project, despite the organisational difficulties such as participants cancelling a few minutes before the set start time of the experiment! Reading and analysing the data was often very amusing, and the multi-lingual environment made it even more entertaining, whilst also improving my knowledge of German, or at least of ‘Tangram task-related German’.

Lastly, I hope I have managed through this project to convey my interest in the phenomenon to the reader, who has hopefully also learnt something from it, be it just the German word for “triangle”!
References


References

Production in Dialogue (Tech. Rep. No. 98/1). Bielefeld University, SFB 360.


A Appendix: Pre-experiment 1: Sheets for Group 1

Figure 35: Sheet 1 for Group 1 in Pre-experiment 1
Figure 36: Sheet 2 for Group 1 in Pre-experiment 1
B Appendix: Pre-experiment 1: Sheets for Group 2

Figure 37: Sheet 1 for Group 2 in Pre-experiment 1
Figure 38: Sheet 2 for Group 2 in Pre-experiment 1
C Appendix: Pre-experiment 2: Participant Sheets

Speaker F=French Native Speaker
Speaker E=English Native Speaker

Figure 39: Sheet 2–Speaker F’s Sheet in Pre-experiment 2
Figure 40: Sheet 1–Speaker E’s Sheet in Pre-experiment 2
D  Appendix: Pre-experiment 2 Conversation

Speaker F=French Native Speaker
Speaker E=English Native Speaker

D.1  Part 1: Speaker F instructs Speaker E in English

D.1.1  Round 1

Figure 1-Sheet 2

Speaker E says: ca marche??
Speaker F says: oui
Speaker F says: vous etes prets?
Speaker E says: bientot
Speaker F says: The first figure should look like a house.
Speaker E says: ok, je suis pret!
Speaker E says: ok
Speaker F says: Start with the pink triangle: it is the roof
Speaker E says: can u give me more details?
Speaker E says: ok
Speaker F says: is the longest part of the triangle to the top?
Speaker E says: No, the other way round
Speaker F says: ok so there is a point to the top?
Speaker E says: at the top even
Speaker F says: Sorry: I was talking about the pale, pinkish triangle
Speaker E says: ok thanks. i have that now
Speaker E says: what next?
Speaker F says: Then, the yellow triangle and the green triangle go under the roof. The two of them make a square: the green one on the left-hand side and the yellow one on the right
Speaker E says: ok, i have that
Speaker F says: Take the dark blue square and set it beside the two-colour triangle starting from the bottom
Speaker E says: to the right?
Speaker F says: Yes (Sorry, i forgot...)  
Speaker E says: ok, done
Speaker F says: Then, you may take the pink triangle and put it on top of the blue square: the longest part should look north
Speaker E says: does it look like a right angled triangle on top of a square?
Speaker F says: Well, I guess so... Actually, if you take the blue triangle you should be able to make a small square with both the pink and the blue triangles.

Speaker E says: is that what you want me to do? make a square with 2 triangles?

Speaker F says: Yes: the pink triangle goes underneath the blue one. The two-colour square should be the same size as the blue square you just made.

Speaker E says: yes

Speaker F says: the 2 squares together are the same height as the two triangles together.

Speaker E says: it is and it is on top of the blue square.

Speaker E says: yes

Speaker F says: Sound! That’s the way it should be. Then, you just need to add the yellow shape, one of the small sides touching the small blue triangle and one of the biggest sides touching the roof.

Speaker E says: ok, done!

Speaker E says: looks like a house now!

Speaker F says: One last thing: make sure that the small pink triangle is left angled, and not right angled as i told you...

Speaker E says: ok, we got it now

Speaker E says: will we move on to next one?

Speaker F says: Can i move on to the second figure?

Speaker E says: yes, go for it

D.1.2 Round 2

Figure 2-Sheet 2

Speaker F says: Right! The second figure is a square.

Speaker E says: ok

Speaker F says: Start with the yellow triangle. It will be the top of the square (longest side at the top).

Speaker E says: ok done

Speaker F says: Then, take the green triangle: it is the left-hand side of the square.

Speaker E says: ok, done

Speaker E says: is the longest side of the green triangle the left hand side of the square?

Speaker F says: It is.

Take the small blue triangle and put it at the foot of the square.

Speaker E says: ok
Speaker F says: the green triangle: we will make a stripe with various shapes
Speaker E says: ok with what other shape?
Speaker E says: when u say stripe, do you mean diagonal?
Speaker F says: the blue square, the pink triangle and the yellow rectangle
Speaker F says: It is a diagonal alright
Speaker E says: i don’t understand. how will the 3 shapes go together?
Speaker F says: I’ll tell you. Start with the blue triangle, longest side down
Speaker E says: yes
Speaker F says: add the blue square on top of it: on side touching the green triangle, the other the blue one
Speaker E says: ok
Speaker F says: then, add the pink triangle on top of the blue square, the longest side not touching any other shape yet
Speaker E says: ok
Speaker E says: i think i have the rest
Speaker E says: does the parallelogram go beside the pink triangle next?
Speaker F says: really? i must be great at giving instructions!!
Speaker E says: then the other triangle on the bottom
Speaker E says: oh you are brilliant with your instructions!
Speaker E says: ready for shape 3 whenever you like
Speaker F says: Grand! Back to our favorite game! Sa Pe number three: it’s really strange, so just follow the instructions
Speaker E says: ready when you are

D.1.3 Round 3

Figure 3-Sheet 2

Speaker F says: Take the three biggest triangles: put the three of them beside each other: the green one on the left, the yellow one in the middle and the pink one on the right. Keep them at a small distance from each other. They are the bottom of the figure
Speaker E says: ok, should I have the longest side of each triangle as the bottom?
Speaker F says: yes
Speaker E says: ok, done
Speaker F says: then take the blue square: it goes between the green and the yellow triangles, but it should be much closer to the yellow one than to the green one (though it does not touch it)
Speaker F says: One of the sides of the triangle should be parallel to the yellow triangle
Speaker F says: I meant “touch” and “parallel” sorry...
Speaker E says: ok, I think#
Speaker E says: which triangle should e parallel to the yellow one?
Speaker F says: the yellow parallelogram goes on top of the green triangle (*horizontal)
Speaker E says: ok
Speaker F says: Sorry; I meant one of the sides of the square;
Speaker E says: are the sides of the parallelogram leaning to the right or the left?
Speaker F says: to the right
Speaker E says: ok, so, there are 3 triangles - green, yellow, pink on the bottom then on to of the green triangle is the yellow parallelogram. beside that is the blue square and that blue square is between the two triangles?
Speaker E says: that right?
Speaker E says: and none of these shapes are touching each other
Speaker F says: Right. Pay attention to the blue triangle: it should look like a star. Then, set the small blue triangle on top of the blue square, the longest side on the right (it does not touch the top of the square
Speaker F says: I meant the blue square!!
Speaker E says: ok, i think it is nearly right but the parallelogram looks a bit funny
Speaker F says: but what i said about the small blue triangle is okay
Speaker F says: the whole shape looks funny anyway, so i guess you’re doing grand
Speaker E says: ok, think i kinda have it
Speaker E says: i’m just not sure about the parallelogram
Speaker E says: tell me about it again
Speaker E says: i have the blue square which looks like a diamond and the blue triangle to the right with the longest side to the right
Speaker E says: but where is the the parallelogram in relation to those?
Speaker F says: The par. goes above the top of the green triangle, small sides leaning on the right, longest sides parallel to the longest sides of the triangles
Speaker E says: ok, let’s try the last shape
Speaker E says: that is the last triangle
Speaker E says: triangle
Speaker F says: The blue square should look like a diamond, so that’s great. Just move the blue triangle a bit upper, closer to the top of the square
Speaker E says: ok so the triangle is kinda on top of the square
Speaker F says: last triangle: it goes on the top right side of the so-called
diamond, longest side on the bottom
Speaker E says: that is the blue triangle is kinda on top of the blue square
Speaker F says: the blue triangle is great as it is now
Speaker F says: still alive? hello...
Speaker E says: tell me about the two triangles in relation the the blue
diamond again
Speaker F says: the blue triangle should be on the top, though more to
the right, of the blue diamond
Speaker F says: its longest face should be on the right
Speaker F says: i meant side, not face
Speaker E says: ok
Speaker E says: just finally tell me where the parallelogram is in relation
to the diamond
Speaker E says: and i think we are good then
Speaker F says: for the parallelogram: it is to the left of the diamond,
small sides leaning to the left (i think i took the right for the left)
Speaker E says: ok, done

D.1.4 Round 4

Figure 4-Sheet 2

Speaker E says: shape 4, let’s go
Speaker F says: the small sides go down to the right or up to the left
Speaker F says: Shape 4: it should look like a candle
Speaker E says: they go down to the right
Speaker F says: they do
Speaker E says: ok
Speaker F says: start with the pink triangle, longest side at the bottom:
that’ll be the bottom of the candle
Speaker E says: ok
Speaker F says: we will make a vertical rectangle with every other triangle
at hand
Speaker E says: oki
Speaker E says: which one will i start with?
Speaker F says: take the yellow one, put it on top of the pink triangle
(left-hand side; longest side to the left)
Speaker E says: done
Speaker F says: add the green one on top of the yellow one, longest side
to the right
Speaker F says: add the white one to finish the rectangle
Speaker F says: are you ok?
Speaker E says: ok
Speaker E says: i am fine, thank u!
Speaker F says: add the blue square on top of the newly formed rectangle
Speaker E says: what about the blue triangle?
Speaker F says: the small blue triangle should go between the pink and the yellow triangles, longest side on the right; Then add the parallelogram vertically on top of the blue square: it is a flame!
Speaker F says: do yo have a perfect rectangle with all the triangles?
Speaker E says: no
Speaker E says: my flame is ok!
Speaker E says: let me tell u what i have
Speaker E says: starting from bottom......
Speaker E says: pink triangle longest side to bottom
Speaker F says: right
Speaker E says: up to the left is yellow triangle
Speaker E says: with longest side to the left
Speaker F says: right
Speaker E says: then on top of that is green triangle
Speaker E says: longest side to right
Speaker E says: where does the next triangle go?
Speaker E says: the blue one is ok too
Speaker E says: it is above the pink one with the longest side to the right
Speaker E says: just confused about the really light coloured triangle and the square
Speaker F says: ok, the blue triangle goes between the pink and the yellow one, to fill in the gap (its longest side to the right)
Speaker E says: got i
Speaker E says: it
Speaker E says: good now!
D.2 Part 2: Speaker E instructs Speaker F in French

D.2.1 Round 1

Figure 1-Sheet 1

Speaker E says: on commence avec les instructions français!!
Speaker F says: vas-y, roule ma poule
Speaker E says: ok, le premier forme est un triangle
Speaker E says: on commence avec le triangle en bleu
Speaker F says: ok
Speaker E says: c’est au fond
Speaker F says: le plus grand cote en bas?
Speaker E says: avec le plus grand face a droit
Speaker F says: ok
Speaker F says: ensuite?
Speaker E says: le plus grand face est vertical
Speaker F says: c’est fait
Speaker E says: le triangle en jaune
Speaker F says: oui...
Speaker E says: le plus grand cote est a gauche
Speaker E says: il touche le triangle en bleu
Speaker F says: a gauche de quoi?
Speaker E says: pardon, le plus grand cote du triangle jaune touche le triangle bleu
Speaker F says: en haut ou en bas du triangle bleu?
Speaker E says: en haut
Speaker F says: ok
Speaker E says: maintenant, prend le plus petit triangle
Speaker E says: c’est en rose?
Speaker F says: oui
Speaker E says: ok, le mettre en haut du triangle jaune
Speaker F says: il est beige, mais t’inquiete, je sais duquel tu parles
Speaker F says: c’est fait, roger
Speaker E says: le plus grand cote reste en haut du triangle jaune
Speaker E says: mettre le carre a cote du traingle beige
Speaker F says: pas de problemo, amigo!
Speaker E says: le cote gauche
Speaker E says: prends le grande triangle rose
Speaker F says: c’est fait
Speaker E says: c comme le bleu
D APPENDIX: PRE-EXPERIMENT 2 CONVERSATION

Speaker F says: ok
Speaker E says: il touche le triangle beige et le carre
Speaker F says: c’est fait
Speaker E says: plus grand cote a droit
Speaker F says: j’ai fini la figure, pepere!!
Speaker E says: mettre le parallelograme a cote du triangle jaune

D.2.2 Round 2

Figure 2-Sheet 1

Speaker F says: Figure 2, c’est quoi?
Speaker E says: yipee
Speaker E says: c comme un pont
Speaker F says: ok, continue, tu m’interesses
Speaker E says: on commence avec le triangle vert
Speaker F says: ok
Speaker E says: c’est au fond
Speaker E says: a gauce
Speaker F says: le plus grand cote en bas j’imagine, non?
Speaker E says: le plus grand cote est a gauche
Speaker F says: ok, j’ai rectifie
Speaker E says: c un triangle rectangle
Speaker F says: non
Speaker E says: ok
Speaker E says: a cote, c le carre
Speaker F says: qu’est-ce qui est un triangle rectangle?
Speaker E says: ca va?
Speaker E says: ok, le triangle touche le carre?
Speaker F says: oui... plus ou moins... Le carre est positionne comment?
Speaker E says: c au fond
Speaker E says: c horizontale
Speaker E says: mettre le triangle beige a l’autre cote du carre
Speaker F says: ok d’ac
Speaker F says: ok
Speaker E says: ca resemble un parallelograme?
Speaker F says: oui
Speaker E says: ok, mettre le parallelograme vert en haut du carre
Speaker F says: ok
Speaker E says: le plus petit cote touche le carre
Speaker F says: ok, et il va vers la droite ou vers la gauche
Speaker E says: a cote du parallelogame est le triangle jaune
Speaker E says: a droite
Speaker E says: le plus grand cote reste sur le triangle beige
Speaker F says: ok
Speaker E says: prend le triangle bleu
Speaker F says: ok
Speaker E says: c bon
Speaker E says: donc, tu as le triangle bleu et il touch le jaune
Speaker F says: ok
Speaker E says: le dernier reste a cote du cet triangle
Speaker F says: j’ai fini
Speaker E says: le plus grand cote est a droit
Speaker E says: bie joue!
Speaker E says: bien joue
Speaker F says: merci, merci
Speaker E says: je suis un bon prof!
Speaker E says: ou instructeur!
Speaker F says: je veux, mon neveu

D.2.3 Round 3

Figure 3-Sheet 1

Speaker E says: ok, le 3eme forme
Speaker F says: troisieme figure, on y va
Speaker E says: ok, prend le triangle bleu
Speaker E says: c’est au fond
Speaker F says: c’est fait
Speaker E says: le plus gran cote est a droite
Speaker F says: la figure ressemble a quoi, au fait?
Speaker E says: je suis pas sur!
Speaker E says: c un peu bizarre
Speaker E says: avec le triangle rose
Speaker F says: ok; laisse tomber la forme generale
Speaker E says: fait un carre
Speaker E says: c a dire un carre avec le premier 2 triangles
Speaker E says: ok?
Speaker F says: c’est bonito
Speaker E says: ok met le triangle vert
Speaker E says: en haut
Speaker E says: a gauche
Speaker E says: avec le plus grand cote a gauche aussi
Speaker F says: ok, il est petit: je le mets au milieu?
Speaker E says: non
Speaker E says: tout a gauche
Speaker E says: mets le carre a cote
Speaker F says: ok, c’est le plus grand cote du triangle qui touche le carre rose et bleu?
Speaker F says: ok, j’ai trouve
Speaker E says: donc, le carre touche les 2 triangles
Speaker F says: la suite?
Speaker E says: le parallelograme
Speaker E says: c a droite du carre
Speaker F says: oui
Speaker E says: avec le petit cote touchant le carre
Speaker F says: ok
Speaker E says: le somme du grand face du gauche au droite
Speaker E says: le sommet
Speaker F says: j’ai fini
Speaker E says: tous l’objet?
Speaker E says: tout
Speaker F says: tu es vire, au revoir!
Speaker E says: haha
Speaker E says: apres toi
Figure 41: Sheet 1 for Final Experiment
Figure 42: Sheet 2 for Final Experiment
Appendix: Photographs of Constructions

For a photograph of each construction achieved, see CD enclosed.

Each photograph is named according to the model: “PartXFigYShZ” or “SpXYFigZShW”. These names indicate:

- The participant who constructed the figure:
  PartX = Participant X from the community group
  OR
  SpE1 = English native speaker from monogamous pair 1
  SpG1 = German native speaker from monogamous pair 1,

- The number of the figure,

- The sheet number that the figure is from.
Appendix: Guidelines for Monogamous Pairs

- Please ensure that you have been supplied with:
  - A sheet with 6 tangram figures
  - A set of 7 construction pieces

and that you have an open conversation window on the screen in front of you (if not, please ask for help to do so)

- You will be communicating with other participants who will have a sheet with different Tangram figures and a set of construction pieces, whose colours match the ones used in the figures on your sheet. You must alternately:
  - give instructions (by typing them into the conversation window) to your conversant so that he/she can reconstruct the figure which is on your sheet using his/her construction pieces.
  - receive instructions which will be given to you by another participant (they will appear in the conversation window) and following them, construct a figure with the construction pieces you have been provided with.

- When you feel that you have constructed the correct figure or that the participant you are instructing has done so (maximum time per figure: 10 minutes) then you may/must move on to the next figure.

- You can interact as much as you like with your conversation partner, as long as you respect the language restrictions. (please ask to find out which language you are allowed to speak)

- Please note that the identity of your conversation partner will change throughout the experiment.

- Please do not exit the conversation window on your screen!
  Please do not destroy the figure you have just built until a photograph of it has been taken!
  In case of difficulty, please ask for help!!

- Please sign the declaration hereunder.

Thank you for your participation!!
I, ................., hereby confirm that, after having read the above information, I agree to participate in the experiment described. I have been informed that participation is voluntary and that at any time and without giving a reason, I may withdraw my undertaking to participate. I am also aware that my conversation is being recorded for further analysis and give my consent for the results to be published.

Signature:

Date:
Appendix: Questionnaire for Monogamous Pairs Participants

To complete at the end:

Name:

Rate the figures in order of difficulty to instruct: (hardest to easiest)

Did you improve at building?

Did you improve at instructing?

How many different people do you feel you talked to?

Any other comments? (What did you think of the experiment? Did you find it difficult? What did you find difficult...)
I Appendix: Monogamous Pairs Conversations

Speakers A: German Native Speakers
Speakers B: English Native Speakers

I.1 Pair 1

FIGURE 1-SHEET 1

Speaker E: Also ich fange jetzt an, ich beschreibe Bild 1, bist du fertig?
Speaker G: Ja!
Speaker E: Also ganz links nimm eine grüne Dreiecke
Speaker G: Gut!
Speaker E: mit dem 90 Angle unten rechts
dann nimm eine rose Vierecke
und stell es rechts daneben
Speaker G: ja habe ich gemacht!
Speaker E: ganz auf die rose Vierecke, stell einen grünen Parallogramm
mit der kurzeren Seite in Kontakt mit der Vierecke. Und in Richtung Nord-Ost.
Speaker G: ok
Speaker E: Rechts der rosen Vierecke, stell einen weissen Dreiecke, so das das Ganze: 2Dreiecken+rose Vierecke macht insgesamt ein Paralellogramm
Speaker G: (typed this far down in conversation window) ok
Speaker E: Nimm eine gelbe Dreiecke
und stell es auf der weissen Dreiecke
mit der Basis unten horizontal, und die Spitze oben
Jetzt nimm die grosse dunkelblaue Dreiecke
und stell es in Kontakt mit der rechten Seite der gelben Dreiecke
mit dem 90Grad Angle oben rechts, und eine Spitze unten
OK?
Und am letzten: die grosse rose Dreiecke rechts der blauen, mit einer Seite ganz unten am Boden, so, so dass es mit der blauen Dreiecke ein Parallelogramm formt
Das heisst wir haben fast die Basis einer Pyramid
Speaker G: ok
Speaker E: Du bist dran
Speaker G: Kannst Du mir bitte noch einmal die Posotion des grossen blauen Dreiecks zum gelben Dreieck erlaern?
Appendix: Monogamous Pairs Conversations

Speaker E: Das blaue Dreiecke ist rechts des gelben
und bedeckt die ganze Seite des gelben
Die Spitze des gelben ist ganz hoch, auf der gleichen Ebene als die hoheste
Seite des blauen Dreiecks
Speaker G: Ok - ich denke, dass ich die Figur fertig habe.

**FIGURE 1-SHEET 2**

Speaker G: Hello!
First of all our figure will look like a house in the end - so that you have a
general imagination
Speaker E: OK
Speaker G: Take the big green triangle and put it with the 90 degree
angle to the left bottom side.
Speaker E: ok
Speaker G: Then put the big yellow triangle on the long basis to the green
triangle - the result of the two triangles will be a square.
Speaker E: ok
Speaker G: Put the white triangle on top of the square like a roof.
Speaker E: ok
Speaker G: No we have two-dimensional house - we will now build the
third dimension on the right hand side of the house by laying the yellow
parallelogram on the right hand side of the white roof.
Speaker E: ok
Speaker G: There must be some space left under the parallelogram.
There you put the small pink and the small blue triangle again like a square.
The pink one is on the left hand side of the two.
Speaker E: is the right angle of the pink one on the top or on the bottom?
Speaker G: The pink triangle is positioned like the big green one.
Speaker E: ok
Speaker G: Under the two small triangles you put the small blue square
and our house should be finished.
Speaker E: Yep, I have it.

**FIGURE 2-SHEET 1**

Speaker E: Ganz links das gelbe Dreieck, mit dem rechten Angle oben
rechts
Speaker G: ok
Speaker E: Das grüne Parallelogramm vertikal rechts daneben setzen
mit der Spitze ganz oben rechts
I APPENDIX: MONOGAMOUS PAIRS CONVERSATIONS 164

Speaker G: ok
Speaker E: unten dem Parallelogramm, stell das rose Viereck. Es liegt also nicht ganz auf dem Boden, sondern nur eine Ecke berührt das Boden
Speaker G: ok
Speaker E: und unten des rosen Vierecks, stell das grüne Dreieck, so dass die lange Seite des Dreiecks am Boden liegt
Das grüne Dreieck ist unten RECHTS des rosen Vierecks
Speaker G: ok
Speaker E: Das grosse blaue Dreieck kommt rechts der Figur,
Seine Hauptspitze liegt am Boden
Seine linke Seite liegt gegen das rose Viereck und das grüne Dreieck
Ganz rechts kommt das rose Dreieck, so dass es mit dem blauen Dreieck ein Parallelogramm formt
Und letztns: das blaue Dreick kommt ganz unten dem rosen Dreieck, mit der rechten Ecke oben links
Speaker G: Das blaue oder das weisse
Speaker E: Dreieck?
OH entschuldigung! Ja ich meine das weisse Dreieck
Seine rechte Ecke ist gegen die linke Spitze des rosen Dreiecks
Ich meinte seine 90Ecke ist gegen die linke Spitze des rosen
Speaker G: ok - finished

FIGURE 2-SHEET 2

Speaker G: Hello! First of all - as a general imagination - our figure will look like the side-view on a chair in the end!
Take the small blue square and lay it to your far left.
Speaker E: ok
Speaker G: Then take the big green triangle and put it on top of the blue square. The 90 degree angle shows to the left bottom side and contacts the left top corner of the blue square.
Speaker E: ok
Speaker G: Take the white tringle, so that the basis of it shows to the right. The peak of it contacts the top peak of the big green triangle.
Speaker E: ok
Speaker G: Put the yellow parallelogramm on top of the white triangle, so that there will be the peak on the top right hand side.
Speaker E: o
Speaker G: Then take the small pink triangle on top of the yello parallelogramm. As if you would fill the gap that is left. It means the 90 degree
angle of the triangle shows to the top left.
   Speaker E: ok
   Speaker G: our figure should almost look like a tower, which is in fact the
   backside of the chair.
Now take the big yellow triangle an put it on the half of the basis of the
green triangle, which is left. Thereby the 90 degree angle of the yellow
triangle shows to the top right.
   Speaker E: And the yellow traingle is pointing down, and touching the
   floor?
   Speaker G: Exactly!
Now you take the small blue triangle and put it to the left side of the yellow
triangle. The 90 degree angle shows to the left bottom side.
   Speaker E: I have it. Figure 3

FIGURE 5-SHEET 2

   Speaker G: Hello, I cant give you any imagination for our next figure.
   But we will have a try anyway!
So take the big yellow triangle with the 90 degree angle to the right bottom
side.
   Speaker E: ok
   Speaker G: Then take the big green triangle an out it on top of the yellow
   one, so that the basis of the green one shows to the left. the 90 degree nagle
   of the green one gets in contact with the top angle of the yellow one.
   Speaker E: so they are positioned exactly the same, one on top of the other
   Speaker G: Yes on top of each other but the green one contacts the yellow
   one only with one of its short sides.
   Speaker E: ok
   Speaker G: We have got a green peak in our figure now. Put the blue
   square that way tot the peak, that it contacts it with its bottom right corner.
   Speaker E: the bottom right hand corner of the blue square touches the
   peak of the green triangle?
   Speaker G: Exactly!
Now take the yellow prallelogramm, so that it contects with its bottom left
corner the top left corner of the blue square.It looks like the prallleogramm
stands on top of the square corner.
   Speaker E: is the parallelogramm pointing east or west?
   Speaker G: Its pointing north-east.
   Speaker E: ok
Speaker G: Now take the white triangle and lay it to the left of the parallelogramm. The 90 degree angle of the triangle points south-west.

Speaker E: so only the right tip of the white triangle touches the top left-hand corner of the blue square?

Speaker G: Exactly!

Now form a parallelogram of the pink and blue triangles. The pink one is on the bottom. In the end lay the parallelogram in contact to the basis of the big green triangle. They contact only with the 90 degree angle of the blue triangle and one of its short sides.

Speaker E: OK. Jetzt muss ich schon zum 5.

**FIGURE 5-SHEET 1**

Speaker E: OK. Jetzt muss ich schon zum 5.


Jetzt nimm das gruene Paralellogramm, es hangt ganz in der Luft, nur seine untere linke Spitze beruht die rechte Spitze des rosen Dreiecks. Es riecht zum Himmel, Richtung Nord-West, aber seine linke Spitze ist nicht so hoch wie seine obere rechte Spitze. Macht das Sinn?

Speaker G: Erklaere mir nur noch an welcher Spitze des - vergiss es, jetzt habe ich es verstanden. Macht also Sinn

Speaker E: Am letzten, stell ie 3letzen Stucke zusammen, so dass das gruene Dreieck liegt am roten Viereck, mit der 90Ecke unten rechts. Das weisse Dreieck kommt rechts des rosen Vierecks mit der 90Ecke oben links, also in Kontakt mit dem gruene Dreieck. Diese neue Figur haent in der Luft, nur die untere linke Spitze des rosen Vierecks beruehrt die 90Ecke des grossen blauen Dreiecks. Die neue Figur reicht ganz oben zum Himmels sie liegt nicht am bleuen Dreieck, sie
I.2 Pair 2

**FIGURE 1 SHEET 1**

Speaker G: HI are you there?
Speaker E: Yes, I’m here now - although I’m not quite sure how to write with this!
Speaker G: What’s your name?
Speaker E: Afraid I’m not allowed say. I’ve just got these pieces now. Shall I start giving instructions to you now?
Speaker G: Ok, would be fine
Speaker E: Eigentlich muss ich auf Deutsch schreiben. Also in der linken Ecke unten, eine grüne Dreiecke mit der geraden Seite nach innen, und daneben eine rossa Vierecke.
Speaker G: hab ich, ist da dann ein zwischenraum?
Speaker G: in from eines dreiecks?
Speaker G: form mein ich
Speaker E: Nein, der Viereck ist eben so hoch wie der Dreieck. Neben dem Viereck, auf dessen rechten Seite also, ein weisser Dreieck mit der geraden Seite nach innen.
Speaker G: ist das rosa viereck auf der linken seite des grünen dreiecks?
Speaker E: Nein, auf der rechten.
Speaker G: bilden die drei teile zusammen ein neues rechteck?
Speaker E: Nein, eigentlich weiss ich nicht, wie diese Form heisst. Parallelogram vielleicht? Aber ueber dem rose Viereck steht eine andere grüne Form, die eben so weit wie das Viereck ist, und daneben (auf der rechten Seite, ein gelbes Dreieck.
Speaker G: nochmal bitte zu den beiden dreiecken...stehen die auf den beiden seiten des rosa vierecks symmetrisch?
Speaker E: Ich bin kein Mathematiker und weiss nicht, was symmetrisch bedeutet. Aber die “Spitze”; des gruenen ist nach aussen gerichtet, auf der linken Seite.
Speaker G: das passt. Das andere grüne Ding liegt flach auf dem Viereck, oder?
Speaker E: Ja genau. Und neben dem gelben Dreieck (rechts also) liegt ein grosses blaues Dreieck, und zu dessen rechten eine grosse rosa Dreieck, dessen Spitze nach unten rechts gerichtet ist.
Speaker G: wie ist denn das gelbe dreieck? steht das auf der spitze und zeigt nach lings, so dass es einen geraden rand bildet?
Speaker E: Die untere linke Haelfte des gelben Dreiecks stehen auf dem weissen Dreieck.
I APPENDIX: MONOGAMOUS PAIRS CONVERSATIONS

Speaker G: ok, und wie passt das rosane auf das blaue?
Speaker G: bilden die zusammen mit dem blauen ein neues viereck?
Speaker E: Nein, aber das rosane ist eben so hoch wie das blaue.
Speaker G: aber wie passt d

FIGURE 1 SHEET 2

Speaker G: ok, I will describe the next form
Speaker E: Shape, ok go on.
Speaker G: ill be a house, we will first build the bottom
Speaker G: build a square out of the gruen and the yellow triangles, the gruen is an the left and the long side goes from the upper left corner to the right lower
Speaker G: sorry, I mean green...oops
Speaker G: do you have this?
Speaker E: Yes
Speaker G: great, ok then you put the white triangle upon the sarue - it is like a roof, with the small corner upwards
Speaker G: square
Speaker E: All right.
Speaker G: the yellow thing and fit it on the right side of the white triangle in a way that you have a new line from the white corner going to the right...with the small side of the yellow thing
Speaker G: the other small side matches with the bottomline of the yellow triangle
Speaker G: so they build together a new roof that is a bit to long on the right side..allright?
Speaker E: Wait a moment, this will take a while. Are you sure the yellow thing isn’t on the left of the square with the roof?
Speaker G: no, it’s on the right, the house isn’t ready, we will enlarge the house under the roof on the right side later
Speaker E: All right, go on.
Speaker G: take the blue square and put it on the right side of the square (made out of the green and yellow triangles) just on the bottom
Speaker E: Ok,
Speaker G: now you should have a space between the yellow thing and the blue square in form of another square, is this correct?
Speaker E: This is indeedn correct.
Speaker G: fill this with a square made of the left two triangles, pink and blue and the pink has its corner (the short one) in the edge between the big yellow triangle and the blue square
Speaker E: All right, I have that.
Speaker G: you should see a house with a flat roof, do you?
Speaker E: Yes. I think we just have to wait a moment before the

FIGURE 2 SHEET 2

Speaker G: I start
the figure is in the end a chair in shape of en little h
ok?
Speaker E: Okay, that will help. Go on.
Speaker G: take the pink triangle and put the small corner to the left and
up
the long side goes from down left to right up, ok?
then you take the yellow thing and match it in the way that it fits with its
long side to the long side of the pink triangle
Speaker E: Right, have that.
Speaker G: that is the highest point of the chair, we are going down now,
you take the white triangle and fit it so, that its corner goes to the left and
on the right side (the long side of it) follows the line of the yellow thing
Speaker E: All right, go on.
Speaker G: take now the green triangle and put it under the white triangle
in a way that its corner goes to the left, downwards, so the one smaller side
of it matches the left outside of the chair
Speaker E: with its long side facing inwards, you mean?
Speaker G: the long side facing to the right, a part of the triangle goes
out of the line (made from the upper parts)
the white triangle (its short side facing downwards) touches half of the long
side of the green
ok?
then you take the yellow big triangle and fit it on the right side of the figure,
its corner to the right, upwards

FIGURE 3 SHEET 1

Speaker E: Also die naechste. Ein grosses Viereck, das aus blau und rosa
Speaker G: hab ich
Speaker E: Rosa Viereck oben links, halb so lang wie die obere Seite des
grossen Vierecks. Daneben rechts das weisse Dreieck, ebenso hoch wie das
rosane, lange Seite nach rechts gerichtet, unten links bis oben rechts.
Speaker G: ja, is gut
Speaker E: Das gelbe Dreieck liegt rechts, Spitze nach oben. Die Hälfte dieses Dreiecks steht also auf dem großen Viereck.

Speaker G: ok, die andere Hälfte steht nach rechts ausser, richtig?

Speaker E: Richtig. Nun die zwei grüne Dinge. Das Dreieck liegt unter dem gelben Dreieck, lange Seite geht links oben bis rechts unten.

Speaker G: die kurze seite ist halb so lang wie das grosse rosane dreieck?

Speaker E: Ich glaube eher, sie ist halb so lang wie die des gelben Dreiecks. Sie bedeckt die Hälfte der Seite des gelben Dreiecks, die nicht auf dem großen Viereck liegt.

Speaker G: ok, dann ist das grüne dreeick auf dem gelben dreieck, richtig?

Speaker E: Nein, sie liegt unter dem gelben.


FIGURE 5 SHEET 2

Speaker G: ok, now the next figure

it’s a rabbit

take the big yellow triangle

the corner to the right, downwards, it lies on its shorter side

Speaker E: I think I follow, go on.

Speaker G: big green triangle and put its corner to the right, matching the highest point of the yellow one

Speaker E: Okay.

Speaker G: take the blue square and match its corner with the highest of the green one, that will be the head

they touch just on the corner, the square is in a lying way, not standing on its corner

Speaker E: All right, the shape seems very tall so far .... go on.

Speaker G: now the ears, take the white triangle and let its corner facing to the left, its long side follows the left side of the square

Speaker E: Do you mean it’s above the square, or beside it?

Speaker G: above

now give it a little push to the left, ca 30 degree

Speaker E: All right.

Speaker G: ok, take now the yellow thing and put it also above the blue square, the short sides showing upwards, its corner matches the left high corner of the blue square and it builds a line as before the white triangle its line goes from down left to high right #]
Speaker E: I think I follow you. Go on
Speaker G: good, now we do the arms
take the blue and the pink triangle and match them in the same form as the yellow thing
take it also in the same position, from down left to high right
and fit it on the long green line of the big triangle, just below its highest corner
Speaker E: I think I have that.
Speaker G: good

FIGURE 5 SHEET 1

Speaker E: Also, jetzt bin ich wieder dran. Diesesmal habe ich sogar eine Form, eine Katze naemlich. Grosses blaues Dreieck, lange Seite nach innen, rechts. Spitze also nach aussen, links gerichtet.
Speaker G: ok
Speaker E: Das rosane steht rechts, lange Seite nach innen links. Die obere linke Spitze streift die obere rechte Spitze des blauen.
Speaker G: ja, ist gut..
Speaker E: Das gelbe Dreieck liegt zwischen ihnen. Lange Seite neben dem blauen Dreieck, Spitze passt zwischen den beiden Spizen oben.
Speaker G: die kurze seite vom gelben ist also halb so lang wie das rosane
Speaker E: Ja, oder fast halb so lang.
Speaker G: weiter gehts
Speaker E: Jetzt das rosa Viereck. Das ist sozusagen der Kopf. Es liegt, diamantfoermig, auf der linken Spitzt des blauen Dreiecks - oben links also.
Speaker G: hab ich.
Speaker E: Die Ohren bestehen aus den beiden anderen Dreiecken, gruen und weiss. Gruen liegt links und ist nach rechts gerichtet; die lange Seite ist also aussen. Kurze Seite ebenso lang wie die Seite des rosanen.
Speaker G: ja, muesste stimmen
Speaker E: Das weisse steht auf der anderen Seite, nach links gerichtet, Spitze beruehrt die Spitze des gruenen.
Speaker G: also genau wie das gruene auf der anderen seite spiegelverkehrt
Speaker E: Genau. Und jetzt das andere gruene Ding, das steht am anderen Ende des Tiers, auf dem rechten Ende des grossen rosa Dreiecks. Spitze steht auf der anderen Spitze, lange Seite nach aussen - hast du’s?
Speaker G: denk schon, ist die kurze seite vom gruenen halb auf dem rosanen?
Speaker E: Nein, das Ding steht fast senkrecht. Biegt etwas nach links. also geht die linie vom rosenen dreieck von unten links nach oben rechts mit der kurzen seite vom gruenen weiter, oder?
I.3 Pair 3

FIGURE 1 SHEET 1

Speaker E: Hi hi hello my name is brian
Speaker G: Alright first put the pink triangle on the right side
But not in a @normal@ way
So that it is lying on one of his short sides
If you imagine a triangle in normal position, I am talking about its left side short
Than take the blue on side
Put it adjacent to the pink one with its right short side to the right short side of the pink one
That it is a parallelogram now
Than take the yellow one
Put the right short side of the yellow triangle adjacent to half length of the long side of the blue one so that its peak is in one line with blue left short side
Speaker E: Hello at last I can say something! Can you read this?
Speaker G: yeah
Speaker E: great!
I think I may have to start again! so the first pink triangle is on it’s short side, with it’s peak pointing down and to the right? (like pointing south-east?)
Speaker G: first put the pink triangle on the right side
but not in a @normal@ way
so that it is lying on one of his short sides
if you imagine a triangle in normal position, I am talking about its left short than take the blue one
put it adjacent to the pink one with its right short side to the right short side of the pink one
that it is a parallelogram now
than take the yellow one
put the right short side of the yellow triangle adjacent to half length of the long side of the blue one so that its peak is in one line with the blue left short side
on the right is nothing
you should have put the blue one to the left adjacent
Speaker E: I still don’t know which way the pink triangle should be pointing alright
Speaker G: the hypothenuse points to the northeast
Speaker E: okay I have it now... and add the blue one so it’s hypothenuse points to the south west - right?
Speaker G: right!
then add the yellow one
so that its hypo points to the south
Speaker E: ... on top of the top side of the blue triangle, right?
Speaker G: no
next to the left part of the blue hypo
that its peak makes one line with the left corner of the blue one
Speaker E: okay
Speaker G: then the green parallelogram
put it with long side adjacent to the left short side of the yellow triangle
Speaker E: okay, with it’s point pointing north or west?
Speaker G: so that blue, yellow and green one make one horizontal line
Speaker E: okay!

FIGURE 1 SHEET 2

Speaker E: unser Zeit ist ab. nimm die grosse gruene Dreieck, und legt es an einen kurzen Seiten, mit der langen Seiten gegen Nord-Ost
Speaker G: okay
Speaker E: lege die grosse gelbe Dreieck damit zusammen, so dass die ein Quadrat bilden
Speaker G: okay
Speaker E: stell die weisse Dreieck oben drauf, so dass es wie ein haeuschen aussieht
Speaker G: okay
Speaker E: stell die blaue Quadrat rechts unten, zur rechten Seite der gelben Dreieck, so dass seine untere Seite eine Linea mit der gruenen Dreieck macht (klar?)
Speaker G: okay
Speaker E: stell die rosa Dreieck auf dem blauen Quadrat, mit lange Seite gegen Nord-Ost, dann stelle die blaue Dreieck damit zusammen so dass die 2 Dreiecke ein Qua
Speaker G: okay
okay
hallo?

Speaker E: bin wieder da
okay,. stell die parallelogram mit der lange seite zur wiessen dreieck, and
kurze seite zur blauen dreieck (jetzt wieder wie ein Haeuschen) klar?
   Speaker G: okay, done
next one take the blue triangle *(line then deleted)*
   Speaker E: okay, du bist nochmal dran... in English
you still there??
Hellooo

**FIGURE 3 SHEET 1**

   Speaker G: take the blue triangle
that its long side points towards northeast
   Speaker E: grand...
   Speaker G: take the pink one and put it together with the blue one that
they make a quadrat okay?
   Speaker G: take the pink quadrat and put it on top of the big quadrat
(which you just made), on the left side of the short side of the pink triangle
okay??
   Speaker E: yep, a square
   Speaker G: then take the green parallelogram and put one of its short
sides to the left of the small pink quadrat
so that it points towards southwest
are you alright?
   Speaker E: sorry I could’nt hear you for a while - now I’m back
yes, okay now
   Speaker G: so then take the white triangle
and put it with its left short side to the right side of the pink square
   Speaker E: and with it’s other shortside touching the pink triangle?
   Speaker G: then take the yellow triangle and put it with its left short side
to the hypothenuse of the white one
that its peak points north
and then finally take the green triangle and put it with its left short side to
the right (free) side of the hypothenuse of the yellow triangle
finished!
   Speaker E: wait - stop a moment!
Speaker G: alright?
   Speaker E: No it’s okay no *(then deleted)*
just to check... the white triangle’s long side is pointing south-east, and the
yellow triangle is inserted in between it and the pink triangle?
   Speaker G: yes!
Speaker E: and then the green triangle is under the right half of the yellow triangle, and also touching the pink triangle?
    Speaker G: grand:)
    Speaker E: okay

FIGURE 3 SHEET 2

Speaker E: okay, ich bin’s nochmal. Du wirds ein langen senkrechten Viereck bauen, der etwa wie eine Kamine aussieht.
stelle die rosa dreieck mit langen seite nach unten
    Speaker G: kay
    Speaker E: stelle die blauen dreieck zusammendamit, so dass die 2 ein dreieck mit langen seite nach nord-westen bilden
    Speaker G: okay
    Speaker E: stelle die gelben dreieck drauf, mit langen seite nach Westen (kurze Seite vom gelben mit lange Seite vom blau/rosa dreieck zusammen
    Speaker G: okay
    Speaker E: Die gruene Dreieck auf dem gelben drauf (kurze Seiten zusam-
    men)
    Speaker G: Okay
    Speaker E: mit lange seite nach osten - okay??
    Speaker G: yip
    Speaker E: weisse dreieck drauf, so dass alle teile zusammen ein senkrechten viereck bilden
    Speaker G: okay
    Speaker E: die blaue quadrat oben drauf (wie obere teil eines Kamines)
    Speaker G: just to make sure:
die obere flaeche des blauen quadrats, wie Rauch aus der kamine -
    Speaker G: fertig
    the blue quare is in the middle of the white short side?
    and it looks like a candle now?
    Speaker E: ja! ja nochmal (wie sagt man ‘candle’ nochmal?)
    Speaker G: kerze
    Speaker E: danke
    Speaker G: fertig

bitte
    Speaker E: gut! du nochmal
    Speaker G: okay...
FIGURE 5 SHEET 1

Speaker G: ready?
Speaker E: yes
Speaker G: the blue triangle is standing on its left peak
Speaker E: okay - long side towards east or west? do you mean with the long side vertical? if so, is the long side to the east or west?
Speaker G: pointing
Speaker E: hello????
Speaker G: with its
Speaker E: testing typing something.... can you read this??
Speaker G: hypothenuse to southeato
Speaker E: okay, blue triangle on left point, long side to SE... next?
Speaker E: hi there.... now I’m blue. how are you?
I have the blue triangle, with it’s long side towards southeast. short sides are towards west and towards north please type something!
Speaker G: alright
Speaker E: okay I see you now. what’s after the blue triangle?
Speaker G: put the yellow one with its long side to the long side of the blue one
Speaker E: towards the top or towards the bottom or middle?
Speaker G: that yellow left ankle touches blue right ankle
(doyou say ankle??)
Speaker E: I think you mean corner?
Speaker G: yes
so then put the pink triangle with its left corner to the left corner of the yellow one and with its long side to the left short side of the yellow
Speaker E: no I’m lost!
Speaker G: Alright the pink long side (subsequently deleted)
Speaker E: actually I think the yellow and blue ones aren’t right yet! I ahve the blue one with long side to the south east. The yellow one’s long side is touching that, and so is facing north-west. Is that right?
Speaker G: right
Speaker G: it is not a real square right now, but somehow next one
Speaker E: okay, but I can move the yellow triangle northeast or southwest along the long side of the blue triangle - so where along do I put it?
Speaker G: pink triangle with long side to left short side of yellow one with its left corner (45 %) to the right corner of the blue one (also 45%)
Speaker E: okay, so do you mean towards the top?
Speaker G: ????
again move the yellow one to the left of the long side of the blue triangle
Speaker E: I’m not sure what you mean by left corner. do you mean left as it is sitting now, or do you mean left if it were sitting upright (that is with the long side downwards?)
Speaker G: allrigth, I always mean left and right in relation to its normal position, resting on its long side
Speaker E: what is it’s normal position! okay I understand now.
Speaker G: so the yellow one should be moved upwards on the long side of thewhatever angle with its left corner to the left corner of the pink one and with its long side on the left short side of the yellow one now you should have a figure which is standind on to corners 2 corners... then put the pink square with one corner on top of the blue peak (90% angle that the other corner of the square faces towards north then put the green triangle with its rigth short side on the left side of the pink square (facing northwest) and the white trangle with its left short side on the right side of the pink square facing north east naechstes??

FIGURE 5-SHEET 2

Speaker E: wir machen eine grosse Hase, die auf den hinterbeine hockt! gelbe dreieck mit lange seite nach nordwesten - okay? hello, is it me your looking for...
I.4 Pair 4

**FIGURE 1-SHEET 1**

Speaker G: hi
i am going to start
Speaker E: Ok
Speaker G: the first one looks like a birgde
take the pink triangle
Speaker E: yes..
Speaker G: and the 90degrees are on the left side
at the bottom
then you take the big blue triangle and the 90degree are on the right top side
put them next to each other
Speaker E: like a square?
Speaker G: no
Speaker E: well like a bow tie?
Speaker G: what is a bow tie/ but never mind
the pink ones 90 degree are on the bottom left
and the blue ones 90 degree are on teh right top
Speaker E: so they dont look like a square together? are they touching?
which one is on top?
Speaker G: yes they are touching
yes they dont look like a spuare
they are seating or lieing next to each other
do you know what i mean
Speaker E: no,,,.sorry!where are the two pieces touching? at the corners?
which corners? or a side, if so which side?
Speaker G: the touch at the side
first there is the blue one and on the right side to it there is the pink one
liek a parallelogramm
Speaker E: ok like a diamond on its side, got it!
next instruction
Speaker G: yes
to the left side of the blue one is the middle yellow triangle
Speaker E: the long side is on the bottom so the blue and yellow are
touching? anf all three corners (pink, blue and tellow) are also touching?
Speaker G: no just the yellow and blue are touching
Speaker E: ok got it next!
Speaker G: take the green thing which is not a triangle
FIGURE 1 SHEET 2

Speaker E: ok jetzt meine
sieht aus wie ein haus
grosse quadrat, gr. dreiecke und gelb daran
90deg. von der gr. drei. am linken seite (unten) verstehst du?
hallo? und dann die/das weisse als dach
Speaker G: nein
mit welchem soll ich angangen
ich hab nur ein blues quadrat
Speaker E: ja sorry, du musst eine quadrat machen
Speaker G: ok mit den 2 dreicken?
Speaker E: genau
Speaker G: ok
weiter
Speaker E: weisse als dach
Speaker G: Ok
Speaker E: gelbe prallogramm daneben
eine lange gelbe flache neben die weisse seite (an der rechrten seite. hast du
das gemacht? jetzt muss du nach ein quadrat machen (aus der rosa und der
blaue) unter die gelbe parallog.
ja?
Speaker G: was?
hallo?
ok
was meinst du mit unter?

FIGURE 3-SHEET 1

Speaker G: ok i start a new one
can you read this?
hello?
i cant see you or read you
Speaker E: Ok
here i am. start giving the instructions for the second oneok
Speaker G: it looks like a pullover
rt zith the stomach
you put the 2 big triangle (pink and blue) tgether like a square
ok?
Speaker E: was yes, which goes on top? and where should the 90 deg b
I APPENDIX: MONOGAMOUS PAIRS CONVERSATIONS

Speaker G: and the pink one the right
the 90degree from the blue is on the bottom left
Speaker E: ok square made
Speaker G: take the pink square and put it on the left top side of the
squaer
Speaker E: ok so its touching the pink triangle yeah??
Speaker G: it is touching the pink triangel on the top left side
Speaker E: done
Speaker G: take the white triangle 90 degree on the top left side
and put it on the right side of the pink square
Speaker E: done
Speaker G: great
now the yellow thing with the long side one the botom and squezze (??) it
inext to the white one
Speaker E: done
Speaker G: so the yellow one is looking over the edge
now take the green triangle
90 degree right on top
put it under the yellow
Speaker E: done
Speaker G: teake the last green thing it is the left arm of the pullover
can you see it??
Speaker E: ok finished, it looks lkike a pullover now

FIGURE 3-SHEET 2

Speaker E: ok, egal, wir mussen noch eine beginnen
diesmal ist es eine kertze (?)
die flamme(? ist die gelbe parallelog.) wie eine diamonde und das ist auf
dem blaue quadrat
and das quadrat ist auf das weisse 3ecke (90deg.oben links)
ja?
Speaker G: ok
Speaker E: und das gru 3eck is darunter (90deg. linken seite in der mitte)
Speaker G: hallo
sichst du mich?
wo bist du
hallo hallo
hallo ballo mallo wallo kollo mollo.....
schreib mir was...
wilst du nacher ein Pfeffermints bonbon??
FIGURE 5-SHEET 1

Speaker G: ok I satrt
it looks like a cat and I satrt with the head
take the small pink square
put it like a diamond
Speaker E: ok
Speaker G: the left ears is a green samll 3angle 90 dregee in the middle
the right ear is white 90 in the middle
Speaker E: so the three corners are touching from green, pink and white?
Speaker G: yes
now the 90 degree of the blue 3 angle is touching the corner of the pink
Speaker E: also the corner of the white, or do u mean the bottom corner
of teh pink?
Speaker G: yes just the bottoms
ok?
Speaker E: ok, so it looks like a standing up cat?
Speaker G: yes but this is just the beginning of the sommach
sorry (later deleted by Rachel)
Speaker E: ok, next!
Speaker G: well the middle stomach is yellow and the long side is touching
the blue long side
Speaker E: ok, i think
Speaker G: so there is a little foot (the blue triangle) the last part is the
pink triangle the long side og the pink is touching the yewlllow
you know?
Speaker E: no, where is it touching the yellow?
Speaker G: well take the pink and put it somehow that it looks like a
stomach and a little foot
kind of like the blue one
ok?
Speaker E: i think im still confused about the blue piece. the 90 deg
angle touches the bottom corner of the head and then the long side of that
blue 3angle is horizontal or vertical?
Speaker G: and the green thing is the taile which touches the top of the
pink top
top
I thing there is no 90 degree angle sorry!!!
FIGURE 5-SHEET 2

Speaker E: ok, jetzt ein kanninchen
Speaker G: I am looking forward
Speaker E: kopf: blau quad.
ohren: weisse 3ecke und gelbe parall.
Speaker G: wo genau ist das weisse dreieck
rechts links
Speaker E: ist schwer zu sagen..
ok, die 90deg ist etwa in der mitte und eine andere ecke ist mit der oben
linke ecke der quadrat.
Speaker G: verstehe ich nciht
Speaker E: ok, egal, wir fangen mit den koerper an.
nimm die gr. 3eck. die langeseite ist parallel mit dem rechte flache des
quadrats.
also nur die zwei ecken (unten rechen des quadrats, und nicht die 90deg. der
3ecke) ja?
Speaker G: also das gelbe 3eck steht auf einer ecke und das gruene?
Speaker E: nein! das gr. steht da!
Speaker G: die eibden grossen Flachen sin
wie steht es da??
Speaker E: ok, gruene 3ecke langeseite ist parallel mit bl. quadrat
Speaker G: ok
steht das dreick auf der Spitze?
Speaker E: ja! ok, als fussen, die groesse gelbe 3eck.
90deg ist unten rechts.
die langeseite ist nebendie unterseite der gr. 3e.
Speaker G: also wie ein Kaninchen sieht meins nicht aus
Speaker E: egal..
die haende sind gemacht mit die bl. 3eck. 90deg unter kopf u neben die gru.
3 eck (lange side)
macht sinn?
Speaker G: nein mein Kannichnchen hat noch keinen Kopf
aber es ist neben dem gru 3eck
Speaker E: kopf=blaue quadrat!!
Speaker G: hat das vieh einen Schwanz??
Speaker E: nein, kopf ist hoher als die korper (gruene 3e). ist es jetzt ein
kann?
Speaker G: was ist mit den gelben ding?
Ich habe noch 3 Teile ubrig
J Appendix: Guidelines for Community Group Pairs

- Please ensure that you have been supplied with:
  - A sheet with 6 tangram figures
  - A set of 7 construction pieces
  - A personalized instruction sheet with a description of each round

and that you have a window on your screen with a list of 4 participants marked as “online” (if not, please ask for help).

- You will be communicating with other participants who will have a sheet with different Tangram figures and a set of construction pieces, whose colours match the ones used in the figures on your sheet. Following your personalized instruction sheet, you must alternately:
  - give instructions (by typing them into the conversation window) to your conversant so that he/she can reconstruct the figure which is on your sheet using his/her construction pieces.
  - receive instructions which will be given to you by another participant (they will appear in the conversation window) and following them, construct a figure with the construction pieces you have been provided with.

- When you feel that you have constructed the correct figure or that the participant you are instructing has done so (maximum time per figure: 10 minutes) please call one of the “assistants”, so she can take a photograph of the figure you have just built or instructed.

- Once the 10 minute deadline is up, you must move on to the next round, by clicking on the participant on your list indicated on your instruction sheet.

- You can interact as much as you like with your conversation partner, as long as you respect the language restrictions.

- Please do never exit any conversation window on your screen! (unless you have been instructed to do so)
  Please do not destroy the figure you have just built until a photograph of it has been taken!

- Please sign the declaration hereunder.
Thank you for your participation!!

I, ....................., hereby confirm that, after having read the above information, I agree to participate in the experiment described. I have been informed that participation is voluntary and that at any time and without giving a reason, I may withdraw my undertaking to participate. I am also aware that my conversations are being recorded for further analysis and give my consent for the results to be published.

Signature:

Date:
Appendix: Example of Personalized Instruction Sheet

Participant 1

Round 1: describe Figure 3 (Sheet 1) in German to Participant 5
Round 2: receive instructions in English from Participant 6
Round 3: describe Figure 5 (Sheet 1) in German to Participant 7
Round 4: receive instructions in English from Participant 8
Round 5: describe Figure 1 (Sheet 1) in German to Participant 5
Round 6: receive instructions in English from Participant 6
Appendix: Questionnaire for Community Group Participants

To complete at the end:

Name:

Rate the figures in order of difficulty to instruct: (hardest to easiest)

Did you improve at building?

Did you improve at instructing?

Any other comments? (What did you think of the experiment? Did you find it difficult? What did you find difficult...)
MAppendix: Community Group Conversations

M.1 Round 1

FIGURE 3-SHEET 1

Participant 4 says: Hallo
Participant 4 says: Hier ist es
Participant 4 says: Es gibt 2 Dreieck, die ein Platz bilden
Participant 6 says: Hallo
Participant 4 says: Hi
Participant 4 says: OK
Participant 4 says: Nehm das erste Dreieck und das zweite und bilden ein Platz
Participant 4 says: Hast du dass verstanden?
Participant 4 says: Hast du dass verstanden Nummer 7?
Participant 6 says: Meinst du mit "Platz" ein "Quadrat"?
Participant 4 says: Ach ja - danke
Participant 4 says: Bild ein Quadrat bitte
Participant 6 says: Soll ich die 2 groesser oder die 2 kleineren Dreiecke nehmen?
Participant 4 says: grosseren
Participant 6 says: Ok
Participant 4 says: gut
Participant 4 says: dann nehms das kleine quadrat
Participant 6 says: Was jetzt?
Participant 6 says: ok
Participant 4 says: auf der linken seite des oberen rands des groesseren quadrats
Participant 6 says: Was soll ich jetzt machen?
Participant 4 says: da du ein L bildest
Participant 4 says: geschafft?
Participant 6 says: hab das leider nicht verstanden - was soll ich mit dem kleinen Quadrat machen?
Participant 4 says: ein L bilden
Participant 4 says: mit dem neuen quadrat aus 2 dreiecke
Participant 4 says: dann, auf der linken seite des kleinen quadrats dieses ding, das nicht ein quadrat/dreieck ist

MAPPENDIX: COMMUNITY GROUP CONVERSATIONS
Participant 4 says: auf der rechten seite des kl. quadrats ein kleines dreieck
Participant 4 says: auf der rechten seite davon, das mittlegrosse dreieck - was auch auf dem oberen rand des grossen quadrats sitzen muss
Participant 6 says: woraus soll ich das L bilden - aus dem kleinen Quadrat und den 2 aus Dreiecken zusammengestellten Quadraten?
Participant 4 says: JA JA!!!
Participant 4 says: hang das andere kleine dreieck unten

FIGURE 1-SHEET 1
Participant 2 says: Hallo
Participant 2 says: Ich beschreibe jetzt nummer 1
Participant 8 says: hi
Participant 2 says: Nimm das gruene triangl
Participant 8 says: alles fit?
Participant 8 says: ok
Participant 8 says: ja
Participant 2 says: und daneben hast du den rosa kvadrat??
Participant 8 says: definiere “daneben”
Participant 2 says: emm.....der dreieck (schuldigung) ist links vom kvadrat
Participant 2 says: ?
Participant 2 says: ok?
Participant 8 says: ok. beruehrt es das Quadrat mit der langen oder mit einer der kurzen Seiten?
Participant 2 says:mit einer der kurzen Seiten
Participant 2 says: ok?
Participant 2 says: und rechts vom Quadrat hast du den beige dreieck
Participant 2 says: der beruehrt das Quadrat auch mit einer seiner kurzen Seiten, liegt aber ein bisschen anders dan den gruenen
Participant 8 says: ok. noch eine Frage: verlaeuft nun die lange Seite des Dreiecks von links oben nach rechts unten oder von links unten nach rechts oben?
Participant 2 says:fuer den gruenen: von links unten nach rechts oben und fuer den beigen: auch von links unten nach rechts oben aber sie spiegeln einander
Participant 8 says: (ich meine dabei das gruene dreieck)
Participant 8 says: ok
Participant 2 says: ok und ueber den rosa quadrat hast du den anderen gruenen ding
Participant 8 says: ist das alles?
Participant 2 says: nein!
Participant 8 says: beruehrt es das Quadrat mit der langen oder kurzen seite?
Participant 2 says: mit der kurzen Seite. zwischen dem gruenen ding und den beigem dreieck gibt’s noch ein dreieck - gelb. es beruehrt den beige dreieck mit halbe der langen seite
Participant 2 says: und daneben hast du die lange Seite vom blauen Dreieck

**FIGURE 3-SHEET 1**

Participant 1 says: hallo
Participant 1 says: nehme dass Balue Dreieck
Participant 1 says: blaue
Participant 5 says: hi
Participant 5 says: ja habe ich
Participant 5 says: was nun?
Participant 1 says: und dass Rosa dreieck und mach ein Viereck aus den beiden
Participant 5 says: ok
Participant 1 says: ein kleines rosa viereck
Participant 5 says: ja
Participant 1 says: und tu es auf die linke site oben von dem grossen viereck
Participant 1 says: dann gibt es so ein gruense langes vierck
Participant 1 says: gruenes
Participant 5 says: ist bei dem viereck das blaue dreieck oben oder unten
Participant 1 says: tue dass auf die linke siete des Grossen Vierecks
Participant 1 says: seite
Participant 1 says: nebem dem kleinen rosa viereck tue das weisse dreieck
Participant 5 says: wie soll ich das gruene lange viereck positionieren?
Participant 1 says: dann nimm dass gelbe dreieck und tue es mit dem weissen dreieck zusammen dass sie ein viereck ergeben aber dass ein teil des gelben dreiecks raus schaut
Participant 1 says: schreck nach unten
Participant 1 says: dass gruene viereck
Participant 5 says: danke sehr gute info Participant 1 says: hoffe ich
Participant 5 says: ich habe noch ein gruenes dreieck, was soll ich damit machen?
Participant 1 says: und dann kommt zum schluss dass gruene dreieck dass auf die siete des gelben dreiecks gehoert
Participant 1 says: auch screck nach unten
Participant 1 says: so dass eine kurze seite davon mit der unteren siete zusammen passt
  Participant 1 says: vom gelben dreieck passt
  Participant 5 says: schliesst das gruene lange viereck mit der oberen kante des roseren quadrates (viereckes) ab?
  Participant 1 says: war dass klar?
  Participant 5 says: ich hoffe
  Participant 1 says: ne mit der seitlichen
  Participant 1 says: schreck nach unten
  Participant 5 says: kannst du die ganze figur beschreiben? wie soll das ergebnis aussehen?
  Participant 1 says: ok?
  Participant 1 says: ein viereck mit zwei fluegeln die aus der seite kommen
  Participant 1 says: die linke Seite laenger dann die andere
  Participant 1 says: ne eigentlich beide die selben laenge
  Participant 1 says: sorry
M.2 Round 2

FIGURE 1-SHEET 1

Participant 3 says: Von Links: kleines grunes dreieck, laengste seite schraeg nach oben, rechte Seite senkrecht. Daneben rechts:
Participant 7 says: Laengste Seite des gruenen Dreiecks schraeg nach oben rechts oder links?
Participant 3 says: Auf dem rosen Quadratt: gruener Parallelogram, schraeg nach rechts
Participant 7 says: AUF dem Quadrat?
Participant 3 says: Ja
Participant 7 says: Nicht vielleicht darueber? Oder so?
Participant 7 says: Was Noch?
Participant 3 says: Im winkel zwischen gruenem Parall. und weissem dreieck: gelbes dreieck
Participant 3 says: zwei gleiche winkel unten
Participant 7 says: Was meinst du?
Participant 3 says: senkrechte seite rechts
Participant 3 says: 90 Grad Winkel oben rechts

FIGURE 1-SHEET 2

Participant 5 says: hi! how are you?
Participant 2 says: hellooo!!!
Participant 2 says: im well, how are u?
Participant 5 says: take the green triangle and put it with the yellow triangle together
Participant 5 says: so that the result is a square
Participant 2 says: ok,
Participant 2 says: which one is on the left, and which one on the right?
Participant 5 says: the green corner should be in the left corner on the ground
Participant 5 says: ok?
Participant 2 says: yes!
Participant 5 says: then you take the white triangle and put it on the top of the square so that it looks like a house
Participant 2 says: ok that's done
Participant 5 says: than you take the blue square and put it on the right side of the big square
Participant 2 says: at the bottom?
Participant 5 says: above the square you put the pink triangle
Participant 5 says: so that it has a border with the yellow triangle in common
Participant 5 says: and then you put the blue triangle on the pink triangle so that they form a square
Participant 2 says: are the two short sides touching the yellow triangle and the blue square?
Participant 5 says: oh yes at the bottom
Participant 2 says: ok
Participant 5 says: exactly!
Participant 5 says: so finally you take the yellow piece with four corners and put it right beside the white triangle
Participant 2 says: with one short side touching the blue triangle?
Participant 5 says: so that it has a border with the white triangle and the blue little triangle
Participant 5 says: yes
Participant 2 says: cool! i think i’ve got it!
Participant 5 says: yeahh!!!
Participant 5 says: so basically there are no spaces at all!
Participant 5 says: all in all it should look like a house
Participant 5 says: yes
Participant 2 says: excellent! you were a very good describer..
Participant 5 says: oh thanks a lot ... you were a good participant as well

FIGURE 1-SHEET 2

Participant 1 says: hallo
Participant 1 says: where are you i am waiting
Participant 6 says: Hallo
Participant 6 says: Sorry, I was disconnected
Participant 1 says: ok no problem
Participant 6 says: Take the green and the yellow triangles and form a square
Participant 1 says: yes
Participant 1 says: and
Participant 6 says: put the whitish triangle on top of the square with the point pointing upwards
Participant 1 says: yes so it looks like a house?
Participant 6 says: yes, so now put the little blue square to the right of the square
Participant 1 says: pointing which way to the yellow side?
Participant 1 says: or green side
Participant 6 says: the little blue square shall be next to the yellow part (on the right) of the big square
Participant 1 says: hello u have to hurry
Participant 1 says: at the top of the big yello side? or bottom?
Participant 6 says: now form another square of the little triangles
Participant 1 says: and put that where?
Participant 1 says: on the other side?
Participant 6 says: put it on top of the blue square
Participant 1 says: should the pink or blue be facing down?
Participant 6 says: both the blue square and the assembled square must be to the right of the big assembled square and thus form a large rectangle, the pink should be facing down
Participant 1 says: ok i see
Participant 1 says: and what do I do with the other thing?
Participant 6 says: sorry, to the right of the house
Participant 1 says: on the roof or by the square?
Participant 6 says: now you should have a rectangle with a triangle on the left, now just put the missing yellow part to the left of the roof of the house
Participant 1 says: ok i think I got it
Participant 1 says: thanks

FIGURE 1-SHEET 2
Participant 4 says: hello
Participant 4 says: do you want to start?
Participant 7 says: The figure looks like a house. The roof consits of a bright yellow three edged piece with the longest side showing down and a yellow parallelogram leaning against it. Both pieces together form again a three edge with the longest side down.
Participant 4 says: is the three edged piecec the largest triangle?
Participant 4 says: hello?
Participant 7 says: No. The rest is a quadrat. From the left: green three edged piece
Participant 4 says: ok so the “square”/quadrat is in the middle?
Participant 7 says: with the 90 degree edge forming one corner. The bigger yellow three edged piece forming with it a quadrat.
Participant 4 says: ok done
Participant 7 says: No. it forms only the left part of the rest of the house.
Participant 4 says: what next please?
Participant 7 says: Next to the big square(=two three edges) there is a little blue square forming the right corner
Participant 4 says: ok
Participant 7 says: And above it is a little pink three edge (what is the English expression?) lying like the big green one and another little blue three edge above forming again a little square. That’s it. Does it look like a house?
Participant 4 says: ok next please - what do i do with the smallest triangle?
Participant 7 says: What colour?
Participant 4 says: triangle is Dreieck
Participant 7 says: What colour hs it?
Participant 4 says: yes - i dont think that the colours are the same as the ones on the sheet
Participant 4 says: its ok i have a house made
Participant 4 says: thank you

FIGURE 1-SHEET 2

Participant 8 says: hi nr. 4!
Participant 3 says: hi
Participant 8 says: ok, take the big green triangle and place it in a way such that the long side runs from top left to bottom right
Participant 3 says: ok
Participant 8 says: place the big yellow triangle so that both triangles form a square
Participant 3 says: ok
Participant 8 says: on top of that square, place the “almost - white” triangle on top of that square
Participant 3 says: ok
Participant 8 says: to the right of the square, place the little blue square such that one of the short sides of the green triangle and the lower end of the little blue square are on one hight
Participant 8 says: (the blue square is adjacent to the yellow triangle)
Participant 3 says: is it not the yellow triangle on the right?
Participant 3 says: ok i think
Participant 8 says: yes, but the bottom of the big square you formed at the beginning is constituted by the green triangle
Participant 8 says: by one of its short sides, that is
Participant 3 says: ok
Participant 8 says: with the three triangles and the little blue one you should have something that looks vaguely like a house with a garage to the right...
Participant 8 says: now, place the red triangle with its short sides adjacent to the yellow triangle and the little blue square
Participant 3 says: yes
Participant 3 says: ok
Participant 8 says: put the little blue triangle with its long side right next to the red triangle’s long side
Participant 3 says: ok
M.3 Round 3

FIGURE 5-SHEET 1

Participant 4 says: hallo nummer 5
Participant 4 says: gruess dich
Participant 4 says: wir bilden eine katze
Participant 8 says: ok
Participant 8 says: schiess los
Participant 4 says: das kleine quadrat soll kopf sein, ok?
Participant 8 says: ok
Participant 4 says: aber es steht auf ein eck - wie ein “diamond”?
Participant 8 says: ok
Participant 4 says: die 2 kleine dreiecke bilden die ohre
Participant 8 says: jep.
Participant 4 says: die liegen auf 2 seiten/raende des diamonds - was ist diamond auf deutsch?
Participant 4 says: nehm dann ein grosses dreieck
Participant 8 says: welche farbe soll wohin (bei den Ohren)
Participant 8 says: die Farben sind auch wichtig!
Participant 8 says: “Diamant”
Participant 4 says: blau
Participant 4 says: blaues dreieck
Participant 4 says: das mitte eck soll mit dem diamant treffen
Participant 8 says: und die Ohren? soll das gruene Dreieck rechts oder links vom Kopf sein?
Participant 4 says: grune dreieck links
Participant 4 says: ok das gelbe dreieck sitzt unten dem blauen
Participant 4 says: das rosa, das gelbe und das blaue dreieck treffen
Participant 8 says: soll die Ecke vom blauen Dreieck mit der freien Ecke des Diamanten zusammenkommen oder mit einer der Seiten?
Participant 4 says: mit der freien ecke bitte
Participant 8 says: und das grosse blaue und das grosse rosa Dreieck beruehren sich jeweils mit ihren langen Seiten?
Participant 4 says: nein
Participant 8 says: sondern wie?
Participant 4 says: unten des blauen setz das gelbe
Participant 4 says: damit du das rosa auf der rechten seite des gelben setzen kannst
Participant 4 says: es ist sehr schwierig sorry!
Participant 4 says: ok
Participant 8 says: schreib mir bitte mit welchen (kurz oder lang)siehen sich alle Dreiecke berühren
Participant 4 says: blaue (lange seite) berührt lange seite galb
Participant 8 says: *gelb
Participant 4 says: und auch in welche Richtung die langen Seiten der Dreieck verlaufen (horizontal, vertical, von links oben nach rechts unten,...)
Participant 8 says: ok
Participant 4 says: von links nach oben,
Participant 4 says: lange seite rosa berührt rechten seite gelb
Participant 4 says: das “parallelogram” bildet den schwanz
Participant 4 says: sorry

FIGURE 5-SHEET 1

Participant 2 says: hallo nummer 7!!wie geht’s?
Participant 6 says: Hallo! Gut, danke
Participant 2 says: ok, die spitzen vom grünen und weissen dreieck berühren einander
Participant 2 says: wie ein krawatte...??
Participant 6 says: ja
Participant 6 says: wie ein mascherl eher
Participant 2 says: ok und darunter kommt den rosa quadrat, sieht aus wie ein diamant
Participant 2 says: mascherl verstehe ich nicht, aber ok..
Participant 6 says: berührt das quadrat die dreiecke?
Participant 2 says: ja - beide!!verstehst du?sie passen zusammen?
Participant 6 says: dann hab ich die falschen spitzen zusammengesetzt
Participant 2 says: schuldigung!!
Participant 2 says: ok jetzt?
Participant 2 says: nimm das blaue dreieck und nur die spitze berührt die untersten spitze des rosa quadrats
Participant 6 says: wie muessen die dreiecke liegen? nebeneinander oder untereinander
Participant 2 says: nebeneinander
Participant 2 says: gegeneber einander eigentlich...
Participant 2 says: wie in einem spiegel
Participant 6 says: ach ja, jetzt hab ich’s, also das rosa quadrat muss ich so drehen, dass es in die Dreiecke passt, oder?
Participant 2 says: genau!!
Participant 2 says: und verstehst du auch dass mit dem blauen dreieck?
Participant 6 says: ok, das blaue dreieck ist unten dran
Participant 2 says: es liegt schraeg, also keine von der seiten beruehrt das quadrat, nur die spitze
  Participant 6 says: was jetzt
  Participant 6 says: ok
  Participant 2 says: die laengste seite ist am weitesten weg vom quadrat und die laengste seite des gelben dreiecks beruehrt die laengste seite des blauen dreieckes
  Participant 6 says: ok
  Participant 2 says: und rechst vom gelben dreieck liegst du das rosa dreieck - die laengste seite beruehrt eine von den kurzen seiten des gelben dreieckes
  Participant 6 says: also das gelbe dreieck liegt neben dem blauen und die spitze davon ist oben
  Participant 2 says: die spitze ist oben ja, aber das dreieck liegt ein bisschen schraeg
  Participant 2 says: nach rechts
  Participant 6 says: ist das rosa dreieck jetzt rechts neben dem gelben kleinen?
  Participant 2 says: genau!!
  Participant 6 says: was mach ich mit dem gruenen ding?
  Participant 2 says: und die spitze beruehrt ein spitze des grune dings
  Participant 6 says: die spitze von was?
  Participant 2 says: tschuess!!

FIGURE 5-SHEET 1

Participant 1 says: hey
Participant 7 says: Hi. So what does the figure look like?
Participant 7 says: Ups, sorry, German!
Participant 7 says: Kannst du die Figur beschreiben?
Participant 1 says: nemm dass rosa vierck und tue in der positon von einem diamanten
Participant 7 says: ok
Participant 1 says: tue das weiss und gruene dreieck jenseits auf jeder siete
Participant 1 says: von dem rosa diamneten
Participant 7 says: Welche Seite?
Participant 7 says: An die Ecken?
Participant 1 says: oben an den oberen seiten
Participant 7 says: ok
Participant 1 says: so dass wie zwei hoerner auf einem kopf ausschauen
Participant 7 says: ok, hab ich
Participant 1 says: nemm das grosse blaue dreieck und tue die spitze die obere an die untere seite des rosa vierecks
Participant 7 says: Was noch?
Participant 1 says: nemm dass rosa grosse
Participant 7 says: ok
Participant 1 says: tue die seitlichen spitzen zusammen
Participant 1 says: aber dass gelbe dreieick muss zwischen dem rosa und blauen passen
Participant 7 says: Meinst du, dass die jeweils laengsten Seiten der beiden Dreiecke sich beruehren?
Participant 1 says: so dass die obere spitze des gelben halbwegs dem rosa dreieick an der side ist
Participant 1 says: dass unten zwei fuesse sind so zu sagenun oben fasst gerade flaeche ist
Participant 1 says: dass gelbe dann zwischen ist teil des koerpers
Participant 7 says: Sorry, versteh ich nicht. Liegt das rosa Dreieck unter dem blauen? In welcher Position?
Participant 1 says: ne neben dem blauen sie muessen sich an den spitzen zusammen gehen
Participant 1 says: von beiden die seitlichen spitzen
Participant 1 says: dass beide oberen spitzen in gegen position ziegen
Participant 1 says: zeigen
Participant 1 says: klar?
Participant 7 says: Aber die Spitze des blauen ist doch an der Spitze des rosa QUADRAT, oder nicht?
Participant 1 says: ja die obere spitzu ich rede ueber die seitlich Spitze
Participant 1 says: spitze
Participant 7 says: Net ganz. Was ist mit dem gelben Dreieck nochmal?
Participant 1 says: und die obere spitzu vom anderen grossen rosa ist in der gegen position
Participant 1 says: das gelbe muss da zwischen passen
Participant 7 says: Und muss ich das Parallelogramm benutzen?
Participant 1 says: so dass die untere side des dreeicks des gelben and der unteren seite des blauen zusammen geht
Participant 1 says: ja dass kommt an der oberen spitzu vom dem rosa
Participant 1 says: rosa an dem blauen
Participant 7 says: In welcher Position?
Participant 1 says: wie dass
Participant 1 says: sorry
Participant 1 says: das grüne muss an den Rosa

FIGURE 5-SHEET 1

Participant 3 says: hi.kleines grünes dreieck oben links. längste seite senkrecht, 'spitze' nach rechts
Participant 5 says: hi
Participant 5 says: ok
Participant 3 says: dann, spitze des kleinen weissen dreiecks trifft spitze des grünen (als ob es einen senkrechten Spiegel gäbe)
Participant 3 says: alles klar?
Participant 5 says: ja
Participant 5 says: ja weiter
Participant 3 says: dann, kleines rotes quadratt passt in den untenen Winkel zwischen den beiden spitzen, etwa wie ein diamant
Participant 5 says: ok
Participant 3 says: dann, grosses blaues dreieck darunter, spitze trifft untere ecke des quadratts
Participant 5 says: kannst du das genauer beschreiben?
Participant 3 says: bisschen kompliziert. de
Participant 3 says: sorry
Participant 5 says: die ecke die zwischen den kurzen seiten liegt?
Participant 3 says: 90 grad winkel trifft untere ecke des quadratts
Participant 5 says: ok, weiter
Participant 3 says: rechts, spitze zeigt nach links
Participant 3 says: aber nicht ganz senkrecht
Participant 5 says: hm...eine seite des blauen dreiecks grenzt an eine seite des roten quadrates?
Participant 3 says: nicht ganz
Participant 3 says: die spitzen ecken grenzen aneinander
M.4 Round 4

FIGURE 5-SHEET 2

Participant 2 says: hey how are you!
Participant 7 says: Hi! The figure looks like a sitting rabbit looking to the left side.
Participant 2 says: ok!
Participant 2 says: where do i begin?
Participant 7 says: I start from the bottom. The big yellow triangle lies with the 90 degree edge forming the right corner.
Participant 2 says: ok
Participant 7 says: The green triangle lies with the top to the right on the up corner of the yellow one.
Participant 7 says: Difficult.
Participant 7 says: The green top edge sows to the right
Participant 7 says: shows
Participant 2 says: is it just the ‘peaks’ of the triangles which are touching or are the sides touching too?
Participant 7 says: It is also one side.
Participant 2 says: ok i get it! and now?
Participant 7 says: The peak of the green shows right and the side showing right down is lieng on the yellow.
Participant 2 says: ok thats done! and now?
Participant 7 says: Now the “arms” of the rabbit.
Participant 7 says: The blue triangle is with its ride side on the green long side (showing left)
Participant 7 says: My god, RIGHT side
Participant 7 says: orry
Participant 2 says: dont worry! better than my german!
Participant 2 says: ok, is it the longest side of the blue triangle that is touching the longest side of the green triangle?
Participant 7 says: And under it is the pink triangle withe the 90 degree edge showing left up
Participant 7 says: No, the right side. The 90 degree edge is lying on the green
Participant 7 says: Never mind. Lets go on.
Participant 2 says: ok!
Participant 7 says: The head of the rabbit is the blue square
Participant 2 says: and are any of the sides of the pink triangle touching the blue or green triangle?
Participant 7 says: It touches with one corner the edge of the green triangle
Participant 2 says: ok
Participant 7 says: No, the pink does not touch the green at all. only the blue one.
Participant 7 says: Now the ears. Difficult...
Participant 2 says: ok
Participant 7 says: Use the parallelogram as one ear, touching the edge of the blue square (head)
Participant 2 says: which side?
Participant 7 says: The other ear is the light yellow triangle
Participant 7 says: it touches the same edge of the square but shows a little bit more left
Participant 2 says: which side of the square - left or right corner?
Participant 7 says: Put the parallelogram like a diamond, but leaning a little bit to the right side
Participant 7 says: Left corner of the square, sorry
Participant 7 says: leaning
Participant 2 says: bye!
Participant 7 says: Bye. Nice working with you!

FIGURE 5-SHEET 2

Participant 1 says: hallo
Participant 8 says: hi there
Participant 1 says: hey i am waiting
Participant 8 says: ok, we’re doing a kangooroo
Participant 1 says: ok
Participant 1 says: so what doo i do first#
Participant 8 says: first the legs: yellow triangle, with the long side running from lower left ot the upper right corner
Participant 1 says: big or small one
Participant 8 says: then the big green triangle, with its short side adjacent to the log side of the yellow triangle. the green corner between the two short sides and the upper right corner should meet
Participant 8 says: big
Participant 8 says: ok so far?
Participant 1 says: no hold on i am confused
Participant 8 says: together they should resemble the legs and the back
Participant 1 says: tell me about the head perhaps the legs will make more sense then
Participant 8 says: tell what to clarify...
Participant 1 says: i just dont understand
Participant 1 says: what u mean
Participant 1 says: so are both tips of the triangle opposite each other
Participant 8 says: hmm. have you placed the yellow triangle?
Participant 1 says: and the tips meet at the top
Participant 1 says: yes
Participant 1 says: but not sure if its right
Participant 8 says: does the long side go from low-left to high-right?
Participant 1 says: well they look like legs to me
Participant 8 says: so, does it?
Participant 1 says: yeah think so
Participant 8 says: good
Participant 1 says: they are like a mountain shape between the two of them
Participant 1 says: a peak shape
Participant 1 says: ok?
Participant 8 says: now, oh dear, now I’m confused. well, maybe it is a mountain
Participant 1 says: well go on with the rest anyway
Participant 8 says: ok
Participant 1 says: oh dont worry
Participant 1 says: go on
Participant 8 says: does the highest yellow corner touch one of the green corners?
Participant 1 says: yes the side one
Participant 1 says: and two middle corner dont touch each other but face opposite ways
Participant 8 says: the little blue square is the head and should touch the highest green corner with one of it’s corners
Participant 1 says: ok
Participant 8 says: the corner opposite that touching corner is the place where the ears start
Participant 8 says: crap

**FIGURE 5-SHEET 2**

Participant 4 says: hello number 6
Participant 5 says: hi, one moment
Participant 4 says: ok
Participant 4 says: go
Participant 5 says: take the blue square and put it on the right bottom corner
   Participant 4 says: yeah
   Participant 4 says: ok
   Participant 5 says: sorry let us start again
   Participant 4 says: ok fine start again then
   Participant 4 says: -)
   Participant 5 says: take the yellow triangle and put it on the right bottom corner with the 90 degree angle on the bottom right corner
  Participant 4 says: yes done
   Participant 5 says: then you take the green triangle and put it onto the yellow one, so that the corner (between the shorter sides) touches the upper yellow corner
   Participant 5 says: ok?
   Participant 4 says: yeah i think so
   Participant 4 says: next
   Participant 5 says: and than you take the blue square and put it on the upper corner of the green triangle, so that the bottom right corner of the blue square touches the green triangle
   Participant 4 says: ok done
   Participant 5 says: then you take the yellow piece and put it onto the blue square
   Participant 4 says: where on the blue square please
   Participant 5 says: so that the shorter line (of the yellow) extends the left side of the square (in vertically direction)
   Participant 4 says: ok...
   Participant 5 says: and the yellow piece shows to the left
   Participant 4 says: yeah
   Participant 4 says: ok
   Participant 5 says: sorry to the right
   Participant 4 says: yeah done
   Participant 5 says: ok then you take the white triangle and let it touch the blue square as well
   Participant 4 says: ok done
   Participant 4 says: and the 2 little triangles?
   Participant 5 says: so that the long side extends the diagonal of the blue diagonal
   Participant 5 says: and the little blue triangle, you put it on the long side of the green triangle
   Participant 5 says: so that the short side has a border with the green
   Participant 4 says: yeah ok done that
Participant 4 says: and the pink one?
Participant 5 says: and then you put the pink one below the little blue triangle
Participant 5 says: do that it touches the blue triangle and not the green one
Participant 4 says: what does the shape look like and does rge yellow triangle meet the white one

FIGURE 5-SHEET 2

Participant 3 says: hi
Participant 6 says: Hello
Participant 6 says: take the yellow triangle with longest side on the left
Participant 3 says: ok so its 'pointing' right?
Participant 6 says: yes, its point is on the bottom, right side. then put the green big triangle to the left of the longest side of the yellow triangle so that the points of the triangles touch each other
Participant 6 says: the longest side of the green triangle should be straight and on the left side, the longest side of the green triangle does not touch the point of the yellow triangle but is slightly further up
Participant 3 says: ok
Participant 6 says: now put the little blue triangle to the left of the green triangle - slightly below its upper point (the point of the longest side)
Participant 3 says: the point facing the longest side?
Participant 6 says: the longest side of the blue triangle should be left, so the blue tr. touches the green one with one of its shorter sides and its point is facing downwards
Participant 6 says: yes
Participant 3 says: ok
Participant 6 says: so now put the pink tr. below the blue triangle with the short sides of both triangles touching each other
Participant 6 says: the blue and the pink shall form a “rhombus” (like an oblique square
Participant 3 says: ok
Participant 6 says: now put the blue square above and to the left of the green triangle, with the tr.’s point touching one of the square’s points
Participant 3 says: ok
M.5 Round 5

FIGURE 1-SHEET 1

Participant 4 says: ok bin wieder da
Participant 4 says: wir bilden eine bruecke
Participant 6 says: ja, wie?
Participant 4 says: nehm die 2 grosse dreiecke bitte - rosa und blau
Participant 6 says: ok
Participant 4 says: dir beruehren einander in der mitte -, damit sie ein “parallelogram” bilden

Participant 4 says: die lange seite sind parallel
Participant 4 says: auf der langen seite des blauen, beruehrt das gelbe dreieck

Participant 6 says: muessen sich die 2 langen seiten der dreiecke beruehren?
Participant 4 says: nein - die 2 langen sieten durfen sich nicht beruehren
Participant 6 says: ok
Participant 4 says: ok hast du dieses parallelogram gebildet?
Participant 6 says: ja
Participant 4 says: dann nehm das grune parallelogram
Participant 6 says: ja
Participant 6 says: was mach ich mit dem gruenen p.?
Participant 4 says: die freie ecke des blauen beruehrt das parallelogram, und das gelbe dreiecke ist unten in der mitte
Participant 4 says: wenn du die freie ecke des blauen und das gruene p. zusammen stellst - gibt es platz unten fuer das gelbe dreieck
Participant 6 says: das groessere oder das kleinere gelbe dr.?
Participant 4 says: das mittelgrosse
Participant 6 says: das kleinere is ja auch irgendwie gelb
Participant 6 says: ok
Participant 4 says: nein das ist hautgefarbt
Participant 6 says: also das richtig gelbe
Participant 4 says: ok dann mit den 2 anderen dreiecke und dem quadrat musst du ein p. bilden
Participant 4 says: das richtig gelbe ja bitte!
Participant 4 says: p. = quadrat in der mitte, rechts hautgefarbtes dreieck, links grun
Participant 4 says: ok?
Participant 6 says: eja
Participant 4 says: ok....
Participant 6 says: wo tu ich das p. hin?
Participant 4 says: das neue p. unten setzen - quadrat unten des grünen p. und hautgefarbt unten des richtig gelben dreiecks
Participant 4 says: hast getan?
Participant 6 says: ja

**FIGURE 3-SHEET 1**

Participant 2 says: hallo - du wieder!
Participant 2 says: ok, nimm die blaue und rosa dreiecke
Participant 2 says: ok
Participant 2 says: und mach ein quadrat mit ihnen
Participant 2 says: das blaue ist an der linke seite ’auf dem boden’
Participant 8 says: mit dreieckgrenze von links unten nach rechts oben oder andersherum verlaufend?
Participant 2 says: andersherum
Participant 8 says: ok
Participant 2 says: ok, und jetzt liegst du das rosa quadrat ueber das rosa dreieck an der rechten seite
Participant 8 says: ok
Participant 8 says: ist das irgendeine abstrakte Form oder kannst du erkennen was es ist? ein Haus oder ein Tier oder sowas?
Participant 2 says: und eine der kurzen seiten des grünen dings berührt das quadrat auf der linken seite und weist nach unten
Participant 2 says: wie ein kopf mit lange haare??
Participant 2 says: hat es mit dem grünen geklappt?
Participant 8 says: halt, das bedeutet, dass das grüne ding in das rosa dreieck reinragt. irgendwas mache ich falsch
Participant 8 says: das ding ist links vom quadrat?
Participant 2 says: ja
Participant 8 says: und weist nach unten?
Participant 2 says: ja
Participant 8 says: und das kleine quadrat ist and er rechten Seite des grossen quadrats?
Participant 2 says: nein - ueber dem grossen quadrat
Participant 8 says: ueber dem rosa Dreieck?
Participant 2 says: genau!
Participant 2 says: ganz links
Participant 8 says: ach so!!!!!!
Participant 8 says: ok, weiter
Participant 2 says: machen wir weiter - auf der rechten seite des quadrats liegst du das weisse dreieck - eine der kurzen seiten beruehrt das quadrat und die lange seite geht von links unten nach rechts oben
Participant 2 says: und unter der langen seite kommt eine der kurzen seiten des gelben dreiecks
Participant 8 says: du meinst das kleine quadrat?
Participant 2 says: mit spitze nach oben
Participant 2 says: das kleine, genau
Participant 8 says: ok
Participant 2 says: und eine der kurzen seiten beruehrt auch die lange seite des gelben dreiecks unten
Participant 2 says: schuldigung, dass ist ueberhaupt nicht deutlich - das gruene dreieck beruehrt das gelbe von unten..
Participant 8 says: und das kleine gruene Dreieck?
Participant 2 says: liegt unten dem gelben,
Participant 8 says: ist die Figur symmetrisch?
Participant 2 says: eine der leurzen seiten beruehrt 'den rest' der langen seite des gelben
Participant 2 says: ja!symmetrisch genau!
Participant 8 says: ok, dann hab ichs, glaube ich.
Participant 8 says: wie der Kopf einer Stiers
Participant 2 says: yay!schuldigung fuer die schlechten hinweisungen...
Participant 8 says: oder ein Telefon oder so
Participant 2 says: ja!
Participant 8 says: wwar doch gut!

FIGURE 1-SHEET 1

Participant 1 says: hallo da bin ich wieder
Participant 5 says: hallo
Participant 1 says: also nemm dass rosa und blaue dreieck um damit ein parallogram zu formen
Participant 5 says: ja
Participant 1 says: eine kurze seite von einem muss mit der kurzen siete von dem anderem zusammen gehen
Participant 5 says: ja habe ich gemacht
Participant 1 says: nimm grune paralolgram und leg es auf die andere site dass die spitzen vom blauen mit dem gruenen sich beruehren
Participant 1 says: aber zwischen ein platz ist wo dann dass gelbe dreieeck rein muss
Participant 5 says: ja
Participant 1 says: die obere spize vom gelben muss dann auch nach oben zeigen
Participant 1 says: ok?
Participant 5 says: hm..die zeigt bei mir nach unten
Participant 1 says: dann leg dass rosa viereck unter dem parallelogram auf der graden flaeche
Participant 5 says: wie genau?
Participant 1 says: ne kann nicht also die gruen und blaue muessen so stehen dass da zwischen ein grosses dreeick ist wo dann dass gelbe gut rin passt an allen sieten
Participant 1 says: klar?
Participant 1 says: dass rosa muss unter dem gruenen parallogram
Participant 5 says: das gelbe passt toll hinein, aber die rechtwinkelige spizte zeigt nach unten
Participant 1 says: die obere spitze muss nach ober ziegen
Participant 1 says: oben
Participant 5 says: ja habe ich
Participant 1 says: ist dass so?
Participant 1 says: ok hast du dass rosa viereck?
Participant 5 says: ja
Participant 1 says: dass gruene dreieck muss so hin dass mit dem rosa und gruenen zusammen es ein extra langes parallogram ergibt?
Participant 1 says: die obere spitze muss an der untersten kante von dem rosa viereck auf der linken sieite
Participant 1 says: klar?
Participant 5 says: mit dem rosa dreieck?
Participant 1 says: ne mit dem rosa viereck!
Participant 1 says: und dass weisse geht dann uaf die andere Seite des rosa vierecks!
Participant 1 says: so dass die oberste spitze and der obersten seite von dem rosa veireck auf der echten Seite ist
Participant 1 says: klar?
Participant 5 says: ich hoffe

FIGURE 3-SHEET 1

Participant 7 says: Hi!
Participant 3 says: hallo noch mal
Participant 7 says: Und, was geht?
Participant 7 says: Wie sieht die Figur aus?
Participant 3 says: ok, grünes parallelogram lange seiten schrägh nach oben rechts.
Participant 3 says: wie arm eines t-shirts.
Participant 7 says: Ist es eine abstrakte Figur oder stellt sie irgendwas dar?
Participant 7 says: Is dann leichter...
Participant 3 says: das ganze sieht etwa aus wie ein t-shirt.
Participant 7 says: ok, super!
Participant 3 says: grünes paral. ist linker arm.
Participant 7 says: schaut es nach unten?
Participant 3 says: nein, nach oben.
Participant 7 says: Linker Arm von uns aus oder von dem aus, der t-shirt trägt?
Participant 3 says: rotes quadratt gleich daran rechts, wie obere, linke ecke des t-shirts. von uns.
Participant 7 says: ok.
Participant 7 says: Weiter?
Participant 3 says: dann, darunter: rotes und blaues dreieck formen quadratt, blaues links.
Participant 7 says: ok.
Participant 3 says: die ‘grenze’ zwischen ihnen geht von oben links nach unten rechts.
Participant 7 says: super, hab ich.
Participant 3 says: Das ist hauptteil des t-shirts.
Participant 7 says: Alles klar. Weiter?
Participant 7 says: Bilden die anderen beiden uebriggebliebenen Dreiecke auch ein Quadrat?
Participant 3 says: dann, oben rechts, weisses dreieck, gleich an dem roten quadr. 90 grad winkel oben links.
Participant 3 says: dann, gelbes dreieck passt in den Winkel, zeigt nach oben, form t teil des hauptkoerpers und teil des armes.
Participant 3 says: dann ergaenzt das grüne dreieck den arm.
Participant 7 says: Aber das geleb 3eck ist groesser als das weisse.
Participant 7 says: gelbe.
Participant 3 says: nein.
M.6 Round 6

FIGURE 3-SHEET 2

Participant 5 says: hi i am back again
Participant 2 says: hey hey!!
Participant 5 says: are you ready to solve the last task?
Participant 2 says: go ahead!
Participant 5 says: well
Participant 2 says: yep!!!
Participant 5 says: take the pink triangle and put it on the bottom line so that the 90 degree corner shows to north
Participant 2 says: ok
Participant 5 says: then you put the left triangle onto the triangle ( on the left side)
Participant 2 says: what colour?
Participant 5 says: yellow
Participant 5 says: so that you have a straight vertical line
Participant 2 says: which way is the 90 degree angle pointing?
Participant 2 says: of the yellow triangel
Participant 5 says: to the right
Participant 5 says: and then the blue triangle fits perfectly between the to other triangles
Participant 2 says: are any of the sides touching or just the peaks?
Participant 2 says: ok, i have it!!
Participant 5 says: ok then you put the green triangle on the yellow one
Participant 5 says: so that the 90 degree corner directs to the left
Participant 2 says: which side?
Participant 5 says: finally we should get some kind of a tower
Participant 2 says: ok
Participant 5 says: and than you put the white triangle onto
Participant 2 says: erm....it doesnt look llike a tower yet...but lets go on anyway!
Participant 5 says: take care, that we have to the left and to the right straight lines
Participant 5 says: and no gaps between
Participant 2 says: oh sorry - now i have a tower!!
Participant 5 says: perfect! you are good
Participant 2 says: so the long side of the white triangle is touching on eof the short sides of the green triangle?
Participant 2 says: thank u!
Participant 2 says: and now
Participant 2 says: ?
Participant 5 says: than you put the blue square onto that tower (centered)
Participant 2 says: ok, and the parallelogram?
Participant 5 says: and finally you put the yellow thing onto that blue square, so that the whole picture looks like a burning torch
Participant 2 says: is it just one of the corners of the yellow shape which is touching the blue square, or is one of the sides touching the blue square?
Participant 5 says: one corner touches the blue square
Participant 5 says: and it has a vertical orientation
Participant 2 says: ok, i have it! we’re so GOOD at this game!
Participant 5 says: yes we are! it makes fun with you

FIGURE 3-SHEET 2

Participant 6 says: HI
Participant 1 says: hi
Participant 1 says: ok what do i do
Participant 6 says: take the pink triangle with the point upwards
Participant 1 says: yeah
Participant 6 says: put the purple triangle to the left of the pink with the short sides touching
Participant 6 says: so you have one bigger triangle now
Participant 1 says: i dont have a purple on eblue one though?
Participant 6 says: yes, blue then
Participant 1 says: ok
Participant 1 says: and
Participant 6 says: put the yellow triangle to the left of the assembled triangle with the short side of the yellow touching the longer of the assembled
Participant 6 says: put the green triangle on top of the assembled so that its short side touches the short side of the yellow triangle - you should have a straight side on the left
Participant 6 says: put the whitish triangle abve and to the left of the green triangle, with the long side of the whitish touching the short of the green tr.
Participant 1 says: hey
Participant 1 says: sorry just cut off
Participant 1 says: ok so the yellow short side should be touching both pink and blue
Participant 1 says: together?
Participant 1 says: right?
Participant 1 says: yes ok so how do these 2 shapes come together?
Participant 6 says: ok, so you have the assembled the triangle, the yellow and the green put together?
Participant 1 says: yes think so but how does that go with the other three
Participant 6 says: together with the whitish triangle they should all form a high narrow rectangle
Participant 6 says: the assembled the triangle should be bottom right, the whitish triangle top left, the big triangles are in between
Participant 1 says: i am totally lost
Participant 1 says: i dont not understand what you want me to do with the yello and blue and pink and I dont know is the yello supossed to touch both pink and blue?
Participant 6 says: when you’ve got the rectangle assembled, put the blue square on top of it, and the yellow parallelogram ontop of the blue square - the parallel. should touch the square with one of its point
Participant 1 says: i think I got it
Participant 1 says: so the blue whit and pink are in the middle while the big ones are bon opposite sides of each other one

FIGURE 3-SHEET 2

Participant 4 says: hello again
Participant 7 says: Hi again. The figure looks like a candle.
Participant 4 says: ok..
Participant 4 says: start me off so
Participant 7 says: The flame is the parall. sitting like a diamond
Participant 7 says: Looks up.
Participant 4 says: yeah got it
Participant 4 says: next pls
Participant 7 says: It “stands” in the middle of the blue square
Participant 4 says: yeah
Participant 7 says: The the white triangle. Its 90 degree edge shows left up
Participant 7 says: So the blue Square stands on one of its side
Participant 4 says: ok
Participant 7 says: The longest side of the white triangle looks down right
Participant 4 says: yeah
Participant 7 says: Then the green triangle.
Participant 4 says: go
Participant 7 says: Its 90 degree edge looks left.
Participant 4 says: yeah
Participant 7 says: One side touches the longest side of the white
Participant 7 says: Then the yellow triangle
Participant 4 says: yeah
Participant 7 says: s 90 degree edge looks right
Participant 7 says: One of its sides touches the left down looking side of
the green one
Participant 4 says: ok
Participant 4 says: yeah
Participant 7 says: Then there is space left for another triangle
Participant 4 says: colour?
Participant 7 says: It is formed through the little blue and the little pink
Participant 4 says: ok done
Participant 7 says: The 90 degree edge of the blue shows left and the one
of the pink shows up
Participant 7 says: Perfect. does it look like a ccandle?
Participant 7 says: candle
Participant 4 says: can you tell me - is there a little bit of the blue square
sticking out over the edge of the green on?
Participant 7 says: No, the blue square is in the middle, it is smaller than
the figure it is “standing” on. The edge of the white and the edge of the
green triangle are sticking out a little bit
Participant 7 says: It is like one big figure looking like a long square, then
the blue square standing in the middle of it and then the diamond
Participant 7 says: Got it?
Participant 4 says: nope!
Participant 7 says: Sh
Participant 4 says: does the blue sq. touch the green traingle?
Participant 7 says: No
Participant 4 says: done it!!!
Participant 7 says: ONly the up side of the white

FIGURE 3-SHEET 2

Participant 8 says: first, the small red triangle put like a mountain - long
side facing down
Participant 3 says: ok
Participant 8 says: now, forming a bigger triangle, put the little blue
triangle with its short side adjacent to the short red side that is to the right
of the red mountain peak
Participant 3 says: ok
Participant 8 says: put the yellow triangle with a short side adjacent to the long side of the newly formed triangle
Participant 3 says: done
Participant 8 says: we’re building topwards
Participant 3 says: understood
Participant 8 says: not to the side, i mean
Participant 8 says: ok
Participant 8 says: now, place the green triangle with a short side to the unoccupied short side of the yellow triangle
Participant 3 says: yes
Participant 8 says: still going “topwards” (is there a word like “topwards”?)
Participant 3 says: no, its upwards, but i understand!!
Participant 8 says: put the almost-white triangle in a way such that we get a rectangular shape
Participant 3 says: done
Participant 8 says: that was the word I was looking for. put the little blue square on top of the rectangle. it’s smaller than the upper side of the rectangle so you have to center it
Participant 3 says: yes. nearly there!
Participant 8 says: that’s the candle. now, with the yellow thingy, make a flame starting from the middle of the blue square
Participant 8 says: and going... upwards!
Participant 3 says: pointing right or left?
Participant 8 says: does it look like a candle?
Participant 3 says: yes
Participant 3 says: does the flame slant right or left?
Participant 8 says: first left than right
Participant 8 says: (left slant is lower than right)