A Study of Negotiation Routines in SCMC NS-NNS tandem sessions using Eye Tracker Gaze Data

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DECLARATION

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

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Abstract

This project uses Eye Tracker data to analyze user behaviors in Synchronous Computer Mediated Communication (SCMC). The Eye Tracker data, which consists of gaze and fixation, as well as keystroke data was processed in combination with the output logs (transcripts) of the chat showing how the former is a richer data source for analyzing SCMC environments. Negotiation routines that occurred within the sessions were annotated in ELAN, a language archiving application. Opportunities for language learning in SCMC were explored with a particular focus paid to recasts. An adapted model for Negotiation Routines was derived to cater for the specifics of SCMC environments. Some time was also given to quantifying the concept of ‘noticing’ in Second Language Acquisition (SLA) using Eye Tracker data to guide intuitions about what it may be composed of in SCMC.
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1 Introduction

The aim of this project is to show, first and foremost, that access to Eye Tracker data for the analysis of SCMC environments is important, if not crucial, in understanding the dynamics of this medium of communication. This is shown by contrast to research based on output logs alone.

Once this point has been established, further analysis is carried out to examine any language learning opportunities that this medium of communication may or may not afford the user.

Eye Tracker data is used to observe user behaviours within Negotiation Routines and this reveals patterns in user orientation to SCMC environments in different ways determined by a number of factors, two of which are described in this study; language proficiency level and typing skill.

An effort to understand the concept of ‘Noticing’ as defined in SLA research in SCMC environments is made by tracing user gaze and fixation at points of the chat session when explicit and implicit correctional feedback was provided.

In addition, a model for Negotiation Routines is derived for SCMC environments based on a controlled vocabulary adapted from Varonis and Gass [1985] taking into account the “local asynchronicity” of SCMC. O’Rourke [2008]

Finally, micro-analysis of recasts in the data is carried out and a general description is given in order to determine why, when and how recasts are given and received in informal tandem chat sessions between Native and Non-Native Speakers of French and English.

As using Eye Tracker data to study SCMC is a relatively new approach this study is exploratory in nature. The results presented are qualitative and some suggestions are made for possible future work.

2 Background

2.1 SCMC

Synchronous Computer Mediated Communication (SCMC) is communication that takes place in text-based chat systems. Nowadays, it is one of the most common modes of communication used on the Internet. Since their creation, chat systems have developed in various ways that have enabled users to interact with one, or several partners at the same time, in real-time.

Internet relay chat channels are used in many professional domains; primarily for business and educational purposes Garcia and Jacobs [1999]. Other instant messaging services are frequented by users to ‘chat’ informally on the Internet.

In recent years, popular chat systems such as MSN and Skype have incorporated video chat into their systems meaning that they are no longer solely text based. They have also enhanced chat system interfaces in order to equip users with expressional tools such as emoticons that can map directly to gestures and other paralinguistic cues manifest in face-to-face communication.
An example is given in Kötter [2003]:

“Graphical equivalents of facial expressions like smileys ... help to reintroduce at least a basic sense of place and physical interaction.”

In addition to this, it is now possible to see interlocutor status while engaging in SCMC such as: “X is typing” and “X has entered text”. It is most likely that this feature would affect decisions made by users during phases of private activity.

These technological advancements were made so fast that research of SCMC environments is still only catching up.

Chat-based interaction in Computer Mediated Communication(CMC) has been termed as ‘synchronous’ because of the real-time interaction that the medium affords; “time and communicative space are continuous and shared” O’Rourke [2008].

Garcia and Jacobs [1999] refer to SCMC as “Quasi-Synchronous-CMC”. They state that:

“Although posted messages are available synchronously to participants, the message production process is available only to the person composing the message...thus the process of message transmission... is not synchronous with message production.”

However, this is a comparison made between CMC and other types of synchronous communication such as oral communication. This seems unnecessary as the rest of the title restricts the scope of the adjective ‘synchronous’ to CMC. Within this medium, the communication is synchronous as opposed to asynchronous; email. The time spent drafting units, though only experienced by the user themselves, could be equated to the time spent thinking about what we are going to say before we actually vocalise it in oral communication. Yet, oral communication is not termed as being quasi-synchronous. Therefore, this study employs the term SCMC to describe this form of communication.

2.1.1 Tools for analysing SCMC environments

As chat systems have developed so too have the tools used to analyse them, though perhaps not to same satisfactory degree. Many earlier studies had nothing more to rely on for their analyses than the transcripts of the chat alone, or output logs, as they will be referred to henceforth.

These earlier studies which used output logs as a sole data source, most of which I’m not familiar with, could only account for some aspects relating to the discourse itself failing to enlighten researchers on important factors such as the interactional chat tempo, the users’ paralinguistic and non-linguistic behaviours and the users’ drafting processes and attentional focus. O’Rourke [2008] So in more recent years there has been a call for “richer data collection techniques” Smith [2010]

Many of the later mentioned factors were overlooked as efforts to employ techniques in improving the analysis of linguistic data in this type of communication took precedence. To this effect, many studies began relying on retrospective methods such as “stimulated recall” Lai and Zhao [2006] and “think-aloud
protocols” Lai et al. [2008] as tools to examine the linguistic data collected from SCMC sessions.

These studies were based on task-based chat sessions involving Non-Native Speakers (NNS) of English and were carried out, primarily, to reveal any advantages that SCMC might have as a resource for language learning. Screen capture software was used to record keystroke data in a video file. “Stimulated recall” was thus based on playback of these videos while researchers prompted the participants to comment on anything of linguistic importance that they may have noticed. “Think-aloud protocols” were carried out by encouraging the SCMC user to comment on anything of linguistic importance noticed while they were engaged in the chat session.

In other strands of research, those who focused on analysing SCMC environments, specifically the temporality, sequentially and spatial topology of chat systems began making video recordings of the chat screen and also of the users’ as they engaged in SCMC. Beisswenger [2008]. This was a step in the right direction.

It made a start in accounting for the important factors listed above. More insight was gained into user behaviours in SCMC environments and their orientation to the discourse therein. Yet, analysing this data proved far from straightforward. Video sequences of chat had to be manually encoded, a process which is both labour intensive and time consuming. Furthermore, the direction of users’ gaze captured in the video files could only be estimated. It was hard to classify where users were focusing their attention on the screen and what they were actually looking at could only be more generally inferred by further alignment of both video sources. Beisswenger [2008]

2.1.2 Eye Tracker Data

The current study uses a more modern approach in data collection for analysing SCMC. This approach involved an Eye Tracker which was used to trace and record the users’ gaze on the screen.

Eye trackers have mainly been used in experimental psychology as a resource for understanding the cognitive processes involved in reading, visual search and scene perception. Rayner [2009]

Patterns in language reading are measured by saccades (short rapid movements) and subsequent fixations (short stops of at least 200-250ms). This information is stored as gaze and fixation data in eye tracker data sets.

It seems apt that such a tool be employed in SCMC research. In addition to what it can tell us about attention in reading, it can also provide us with an insight into the processes of language production in SCMC. Furthermore, the eye tracking software enables the collection of timed keystroke data. This facilitates the automatic processing and alignments of all combined data sources.

O’Rourke [2008] documented how eye tracker data revealed more about user tendencies in SCMC such as monitoring behaviours as well shedding a clearer light on the “unique nature of the communicative space”. In light of these findings, he further proposed that greater attention could henceforth be paid to
linguistic data, thus bridging the gap between both strands of research previously mentioned.

Smith [2010] took a step in this direction with a study based on the “effectiveness of recasts in CMC” in which he used Eye Tracker data to observe users’ focus on linguistic forms in task-based NNS interactions in SCMC.

He noted that: “By tracking the eye movements of learners engaged in SCMC interaction, we may gain more compelling, objective, and concrete process-oriented evidence about what learners attend to in the input rather than simply relying on more indirect and product-related measures of noticing.”

Collecting Eye tracker data is, however, costly and interpreting the data is no easy task either. Rayner [2009] documents some of the difficulties in interpretation; measuring the perceptual span of fixations and deciphering what surrounding information is actually being processed during any one fixation. He also showed how saccades and fixations exhibit variability depending somewhat on the accuracy of the temporal and spatial resolutions of the eye tracker used. These factors combined with the high costs involved in obtaining the equipment may be why eye tracker data has not been as extensively used as a data source in analysing SCMC environments.

Rayner [2009] further indicates; “Although it has become increasingly clear that eye movements provide a very good (and precise) index of mental processing in various tasks, it is the case that eye movement research perhaps does not have quite the status many concede to various brain imaging techniques (even though eye movement data typically have better temporal resolution).”

2.2 SLA in SCMC

2.2.1 The Noticing Hypothesis

The Noticing Hypothesis was first derived by Schmidt [1990]. This was expanded upon by Schmidt himself in subsequent work and also by a myriad of other researchers.

The basic claim made by Schmidt [1994] was that;

“noticing is the necessary and sufficient condition for the conversion of input to intake for learning”.

What actually constitutes ‘noticing’ has been under contention for some time now. Schmidt’s original proposal put most of its weight in the role of ‘awareness’ as the conscious component of ‘noticing’. Tomlin and Villa [1994] differed from this in that they claimed that ‘detection’ was crucial for ‘noticing’ to occur and that ‘awareness’ did not need to be activated. Robinson [1995] tried to find a middle ground between the two, proposing that it was

“what was both detected and further activated following the allocation of attentional resources” in Lai et al. [2008].

Despite these discrepancies, the research findings on a whole still imply that noticing is an important cognitive construct in SLA.

Many of these findings helped in establishing the contextual factors that affect ‘noticing’.
It was found that Working Memory, language learner proficiency level, different learning conditions and tasks and the modality in which they were presented were amongst some the acting variables. In Lai et al. [2008].

Philp [2003] listed some additional factors that have been suggested to mediate ‘noticing’; some of which become apparent in the analysis of the eye tracker data in the current study;

- Readiness
- Frequency and saliency in input
- L1 influence
- Prior knowledge - “Leaners’ current grammar acts as a filter on input.”
- Linguistic context of input - the degree to which the discourse is understood
- Degree of difference between the trigger and indicator.

Summarising these factors; she stated;

“Attentional resources and processing biases modulate the extent to which learners notice the gap.” The term “noticing the gap” has been used to describe the cognitive comparisons made by users between their own erroneous productions and the correctional feedback that they are implicitly provided with.

Doughty [2001], who did extensive research on the cognitive macro and micro processes that promote language learning, included it as a crucial factor in SLA development;

“Adult progress in SLA depends crucially upon cognitive processes such as paying attention to features of target input, noticing interlocutor reactions to inter-language output and making insightful comparisons between input and output.”

### 2.2.2 Noticing & Negotiation Routines in SCMC

SCMC environments have been attributed with being conducive to SLA.

Smith [2003b] stated that SCMC “amplifies students attention to linguistic form.” The visual saliency, re-readability and longer processing times afforded by the medium contribute to its usefulness as a method for SLA.

Pellettieri [2000] made similar arguments about the merits of SCMC for SLA;

“...represent a pedagogically sound environment for increasing metalinguistic awareness in L2.”

‘Noticing’ or “selective attention” is at the heart of The Interaction Hypothesis derived by Long [1996].

In his work, he drew attention to the importance of negotiation work between language learners;

“Negotiation work that triggers interactional adjustments by the NS or more competent interlocutor facilitates acquisition because it connects input, internal learner capacities, particularly selective attention and output in productive ways.”
Negotiation Routines can involve both negotiation of meaning and negotiation of form or, indeed, both at the same time.

Pica [1994] defines negotiation of meaning as:
“The modification and restructuring of interaction that occurs when learners’ and interlocutors anticipate, perceive or experience difficulty in message comprehensibility.”

Long [1996] claims of negotiation of form that it
“switches attentional focus from message to form and the needed item in input is noticed”.

Braidi [2002] states that;
“negotiation of form is not only for comprehensibility of message but also for accuracy and precision in form and that it has a more pedagogical and less conversational function of negotiation.”

In SCMC, Negotiation Routines manifest themselves in a slightly different ways to oral communication. The model used for annotating Negotiation Routines in this study was adapted from the model proposed in Varonis and Gass [1985] for oral communication. It was found that, although some aspects needed to be adjusted to cater for SCMC environments, it was still largely representative of the negotiation routines that occurred in the data of the chat sessions. This is further detailed in Section 4.1.2 of the paper.

2.2.3 Recasts

Recasts are forms of implicit correctional input fed to learners during interaction. They are documented as Negotiation of Form routines in this study.

Braidi [2002] defines input as the following:
“Input can be defined as the linguistic forms that are in evidence in the learners’ environment. Positive evidence provides the learner with a model of utterances that are possible and grammatical in the language. Negative evidence indicates to the learner what is ungrammatical in the language”

Recasts are considered as providing negative evidence as they highlight mismatches to the NNS between their own non-target like output and the correct input supplied by the NS. Once ‘noticed’ and perceived as negative evidence, the recast must be held in working memory until a cognitive comparison is made with the original error. Long [1996]

Uptake of recasts is defined by Braidi [2002] as the;
“Incorporation of standard language forms by the learner into their own speech as a result of repaired forms in the interaction”

Smith [2010] tried to measure successful uptake of recasts using ‘post-task writing’ which was based on the recasts provided during the chat sessions in order to determine if users had retained any correctional input.

Many studies have been conducted to determine if recasts are facilitative in SLA from the perspective of both input and output. Results show a lot of variation as multiple factors are at play; such as the contingency of the recasts, their length and their type; grammatical/lexical.
Lai et al. [2008] studied recasts in SCMC using different methods but seemed unconvinced by the results of their research. Smith [2010], having eye tracker data at his disposal, was more confident about his findings, only troubled by his interpretation of fixation data in relation to ‘noticing’.

The current study investigates recasts in an informal setting so it is not worthwhile getting into a statistical comparison at this point.

It is likely that task-based experiments where users are instructed to provide intensive recasts to NNS and that are conducted using eye tracker data, may reveal, to a more accurate degree, user progress in L2 and thus lead to the improvement of language learning software. Whereas, in this study, an analysis of the recasts that occurred in a non-pedagogical setting simply aims to show that NNS may or may not benefit from using SCMC to interact with native speakers of their L2.

2.3 SCMC-SLA vs CMDA

In Section 2.2.2, I made reference to some claims made about the benefits of SCMC for SLA. One of these claims state that SCMC environments are rich language learning environments because of the longer processing times available in chat interactions.

This has been argued in many research papers; Payne and Whitney [2002]; Pelletieri [1999] cited in Smith [2010]. Smith also concurs that online planning time is increased due to “conversations in slow motion” Beauvois [1992] cited in Smith [2010].

It is odd that this characteristic of SCMC is being consistently touted as beneficial to SLA when conventional Computer Mediated Discourse Analysis (CMDA) have been finding evidence that suggests the contrary is the case.

Beisswenger [2008] in a study of the temporal and sequential organisation of SCMC using video recording techniques found that users were very much under a temporal constraint in the medium. This was represented by the tendency to delete whole drafts if they noticed new interlocutor topic-shift units appearing in the chat box.

According to Beisswenger [2008]; “there is technology imposed individuality...text production in chat is discontinuous”. This is in line with the findings of O’Rourke [2008] who described it as the ‘private and public communicative space’. Although the user can choose to dwell in phases of private activity or take their time processing output as SCMC-SLA research suggests, most are otherwise conscious that text production must be quick to maintain an overall agreeable pace and coherent flow in the chat.

It is likely that the claims made in SCMC-SLA may be direct comparisons made with oral communication settings that simply fail to account for the actual dynamic of SCMC environments.
3 Data Analysis

3.1 Methodology & Design

The data used in this study was collected in 2005 by Dr. Breffni O’Rourke in a research project that consisted of roughly 50 tandem chat sessions between Native Speakers (NS) and Non-Native Speakers (NNS) of German, French and Spanish.

In this project I process and analyse the data generated from the French-English sessions only.1

The NNS was placed at a computer equipped with a Tobii Eye Tracker while their NS chat partner was situated in a different room at a regular computer.

These NS-NNS dyads conversed through the medium of MOO, a multiple user chat system, each session lasting approximately 40 minutes. The participants chatted in English for approximately half of the overall chat time, switching to French for the remaining half or vice versa.

Participants were expected to converse freely with their partners and, if desired, to make use of suggested topics listed to the right-hand side of the screen in both English and French. Therefore, this experiment was non task-based. This meant that the linguistic output was more likely to represent the proposal made in Long [1996] about the free conversational forms that are characteristic of informal NS-NNS SCMC sessions;

“metalinguistic focus is lacking....and attempts at overt correction rarely occur”

This differs from other studies conducted to date in SCMC, in that most are realised in a formal pedagogical setting. In Lai et al. [2008] and Smith [2010], the chat sessions were task-based. Learners of English chatted with either native English speakers (Language Researchers) or other NNSs of English to fill in missing bits of information in each other’s stimulus picture or video.

The data collected from the SCMC sessions in the current study, put in context with the studies mentioned above, is comparatively ‘middle of the road’. Although the participants are not ‘friends’ and do not know who their partners are (unless otherwise exposed in the content of the chat itself), their perceived anonymity may have provided them with a SCMC setting more akin to that of a chat session between friends. Furthermore, because of the non-task based setting of these SCMC sessions, the NNSs are not constrained in their output and thus interact in a manner that would be typical of a chat between ‘friend’ NNS-NS dyads.

However, this study does share some pedagogical implications in that the NNS knows they are speaking with a NS of French (sometimes aware that they are language assistants) and are, thus, prepared to accept any correctional feedback provided as well as any language models, both lexical and grammatical, independently observed, as correct.

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1In O’Rourke (2008) an overall insight into the merits of using an eye tracker to analyse SCMC sessions based on the complete data set is given along with findings conducive to the formalism of monitoring patterns and general SCMC user behaviours.
This is reflected in NS behaviours. Some even made explicit comments on their own errors;

- NS - “excuse moi je rectifie quand je me trompe je ne voudrais pas te mettre des fautes d’orthographe dans la tete”\textsuperscript{2}
- NS - “c’est drole quand on tape a la machine on fait des fautes terribles mais ce n’est pas important pour la conversation.”\textsuperscript{3}

Other methods which have been mentioned in Section 2.1.1 such as “stimulated recall” and “think-aloud protocols” were not used in this study. No test of user typing speed was carried out. Whether users were touch or non-touch typists was inferable from watching the video playback of gaze data also exposing their overall typing skills. Working Memory (WM) of users was not measured in this study either. In other research WM has been calculated on the basis of both language independent and language dependent tests. Lai et al. [2008]

Though these parameters were not measured this experiment went one step further than Lai et al. [2008] in that it employed the use of an eye tracker to capture gaze and fixation patterns of the NNSs during the chat sessions. The aim behind this approach was to gather richer data that enabled a more comprehensive study of the SCMC environments as is outlined in Section 2.1.2 above.

3.1.1 Research Questions

1. Does the Eye Tracker data enable us to accurately analyse the first-person experience of a SCMC user; in particular their behaviours and cognitive processes during negotiation routines?

2. If so does it expose any language learning tendencies (noticing and focus on form) in this medium of communication? Do the patterns in user behaviour in negotiation routines reflect the general SLA Interactionist claims; noticing of input cognitive comparison between IL and TL modified output?

3. Finally, where corrective feedback is supplied, specifically Recasts, is it possible to account for why, when and how they are given and received in SCMC?

\textsuperscript{2}NS - “sorry, I’ll correct any mistakes I make, I don’t want to teach you bad spelling”

\textsuperscript{3}NS - “It’s funny that we make such terrible mistakes when typing, but it’s not what’s important in this conversation”
3.2 Materials & Procedure

3.2.1 MOO

MOOs (or Object-Oriented Multiple - User Domains) are computer applications which are used for SCMC and were first developed in the early 90’s. Their earliest incarnations were simple computer games but these were developed into educational MOOs which were then used in computer-assisted language learning classrooms.

As described in Section 2.2, SCMC environments are attributed with providing their users with rich learning environments. In MOO this is due to the provision of, as Kötter [2001] noted;

"a unique sense of space, proximity and even intimacy...most users conceptualise their interactions as real and authentic encounters in spite of the fact that they receive fairly little visual and no aural information about their interlocutors."

For the purpose of this study, many features of the MOO were ignored. Both users simply entered a room; “The French Lounge” to engage in a real-time text-based interaction with their interlocutor. I have provided a screen capture of the MOO interface in Figure 1 below with indication of pixel size. Within this graphical user interface (GUI), there are four main visual spaces each delimited by straight horizontal and vertical lines.

![Figure 1: MOO GUI](image)
• Area A is known as the *Chat Box* and is where the 'live' chat units appear in real time on the users' screen; "shared communicative space".

• Area B is known as the *Draft Box* and is where the user drafts his/her message before submitting it to the Chat Box.

• Area C consists of a list of suggested topics in both English and French.

• Area D is the menu bar for navigating through the MOO and eventually exiting it.

In this MOO, users needed to precede all of their send units in the Draft Box with the word 'say'. This caused some problems when users accidentally erased 'say' while deleting their drafts and then began drafting again only to find upon sending that the software reports the error to the screen “*I do not understand this*” and the unit is lost. This caused some problems in aligning the data and caused momentary confusion for some of the users who experienced it.

The MOO was responsible for providing the output logs. As noted in Section 2.1.1, these are transcripts of the chat sessions as they appeared in the *Chat Box*.

### 3.2.2 Tobii Eye Tracker & ClearView

The NS was placed in front of a monitor with an embedded Tobii 1750 Eye Tracker as shown in Figure 2. This consists of a camera mapped with infrared light diodes that set up reflections on the user’s eyes and estimate their point of gaze on the screen. tob

![Tobii 1750 Eye Tracker](http://www.hcitrack.co.uk/NSellars%20Msc%20HCS_files/image013.jpg)

**Figure 2:** Tobii 1750 Eye Tracker

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\(^*4\)Image location: http://www.hcitrack.co.uk/NSellars%20Msc%20HCS_files/image013.jpg
Calibration measures were taken for each user at the beginning of their session and any slight discrepancies in accuracy were noted. These discrepancies were mostly observed amongst participants who were wearing glasses or mascara and relevant attempts were made to rectify this before proceeding with the chat session.

The Tobii Eye Tracker is accompanied by ClearView software. This application is used to record and store gaze and fixation data as well as keystroke data. It is also in ClearView that the internal settings such as the calibration settings mentioned above are controlled.

Its other function is to enable the processing of the data recorded. Within ClearView, it is possible to export the gaze replay to high quality .avi video files. These contain the videos of the chat screen with the gaze and fixation data superimposed on the screen as a blue line; fixations represented as blue dots. It also provides a special export option for the gaze and fixation data as well as the keystroke data. These were exported to Excel Spreadsheets where it was possible to manipulate and analyse the data in an automated way.

3.2.3 Participants

This paper documents the data processing and analysis of a selection of chat sessions from the French language NS-NNS dyads. This amounted to a total of twelve tandem chat sessions that were eventually analysed, each lasting approximately forty minutes in length.

The NSs enlisted to participate in these sessions were language assistants in the University while NNSs ranged in proficiency levels; all had at least Leaving Certificate French of Higher C3 grade upwards, an entry requirement for their respective degree courses of which French was a component. Others were simply continuing French classes in evening language modules. Some had already lived and/or worked in French speaking countries for a number of months.

3.3 Data Coding

3.3.1 ELAN

ELAN is a freeware application for “language archiving” available for download. In ELAN, it is possible to align video and audio data with tiers containing linked annotations in an interface which facilitates the creation, modification, visualisation and navigation through tiers of different annotations types. ela

The raw data that had been exported by ClearView was mass processed in Excel to facilitate the timed alignment of all data sources. This was executed by concatenating the keystroke data of the NNS into each of their send units which made it possible to calculate the starting time of the drafting of each unit and, in particular the time of their transmission. These start and end times were associated with the NNS units in the output log. This is illustrated in Figure 3.

http://www.lat-mpi.eu/tools/elan/
Keystroke data was only collected for the NNS, so, the NS units were simply accounted for in between these units. An example is given in Table 1 below. If there were multiple NS units, then these were concatenated using <NU> to delimit each one. The transmission times of NS units were manually adjusted in ELAN where necessary.

Once processed, this data was saved as tab delimited files which were then imported to ELAN. Shown in Figure 4.
The videos of the chat sessions could then be viewed at the same time as the annotated tiers which facilitated the efficient analysis of the data.

Furthermore, the various functionalities within the software enabled precision in the alignment of the files and quick and easy access to important parts of the chat sessions via the time bar. A screen view is provided in Figure 5.

3.3.2 Negotiation Routine Model

For the purposes of this study, a negotiation routine model, adapted from Varonis and Gass [1985], was used to annotate the data.

In this adapted model, the continuous coloured arrows illustrate the normal order of any negotiation routine. The dotted black arrows show that this order can be disrupted in SCMC, for example; Indicators can be drafted over two send units or a Reponse can appear before an Indicator due to disrupted turn adjacency. Indicators, Responses and Reaction to Responses can all be Triggers(T) (dotted red boxes) which initiate embedded negotiation routines.

Anything between an Indicator(I) and the final (and optional) Reaction to Response(RR) is encoded as a Response(R). Finally, though it is hard to represent here, the order does not necessarily map directly to the model for oral communication. NS-T, NNS-I, NS-R; can equally be realised as NS-T, NS-I, NNS-R by both users.

This will be discussed further in Section 4.1.2.
4 Results & Discussion

From the outset it was apparent that eye tracker data is a richer data source for analysing SCMC environments. A reliance on output logs alone falls short of accounting for many of the characteristics of SCMC.

By focusing on negotiation routines that occurred within the chat sessions, it became possible to trace the cognitive processes and behaviours of the NNS users by observing their gaze patterns on the chat screen. SCMC is inherently visual in nature and, although linguistic data can be collected in output logs, it is clear that what is lacking in output logs as a data source is vital to a comprehensive study of SCMC.

4.1 General Description of the Data

4.1.1 Tracing the cognitive process and behaviours of SCMC Users in Negotiation Routines

In section 3.1.1, I proposed three research questions, the first of which was:

1. Does the Eye Tracker data enable us to accurately analyse the first-person experience of a SCMC user; in particular their behaviours and cognitive processes during negotiation routines?

The output logs were used as a starting point in analysing the data. These transcripts of the SCMC sessions were examined in order to identify any negotiation routines that took place. Any lexical and grammatical errors made were also underlined. The identified negotiation routines were then viewed in ELAN where it was possible to replay the video of the screen capture, the fixation data and the keystroke data at the same time.\(^6\) This enabled the accurate alignment and annotation of all data sources.

Delimiting Negotiation Routines

The negotiation routines that had seemed relatively banal or uninteresting when observed in the output logs were brought to life by the additional data sources collectively viewed in ELAN. The gaze and fixation patterns as well as the keystroke data surrounding these snippets of the chat ended up warranting more attention over longer periods of time. Initially it seemed logical to delimit the negotiation routines in the output logs as beginning at the Trigger and ending at the final Response or Reaction to Response.

In Figure 6 the negotiation routine is highlighted in grey. It spans from line 3(Trigger) to line 11(Reaction to Response). The topic is continued until line 25. During the production and transmission of lines 12-25 the NNS is still ‘looking back’ to lines in the negotiation routine.

\(^6\)It is possible to view each example given in this section in ELAN; please see Appendix C for further instructions.
This shows that cognitive processes linked to negotiation routines are not contained within the time of their production and transmission but potentially span the whole remainder of the chat session itself or at least continue until the topic of the current thread is changed.

Given this behavioural pattern of ‘look back’, which is touted in SLA literature as a key feature of Interactionist Theory and afforded in particular by SCMC environments, it is clear that using output logs as a sole data source paints an impoverished picture of the users attention and orientation to negotiation routines.

**Searches for Contextual Meaning**

This was equally reflected in the patterns of ‘look back’ that occurred during negotiation routines which exposed a tendency in users to search for contextual meaning in older chat units. The eye tracker data made it possible to trace the journey of the NNS’s gaze from the initial receipt of a Trigger or Indicator to the resolution of the negotiation routines that they engaged in. This facilitated a direct mapping to the NNS’s cognitive processes and behaviours.

Although the story that is told by mapping the gaze data to the cognitive processes of the user could be intuitively recalled in the comfort of an armchair, the eye tracker data draws attention to content in the chat that could be easily overlooked by an analyst on inspection of the output logs alone.
This was the case for the negotiation routine presented in Figure 7, highlighted in grey. A descriptive account of the eye tracker fixation data is given below.

<table>
<thead>
<tr>
<th>Line</th>
<th>Interaction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>NS</td>
<td>“but time passes very fast”</td>
</tr>
<tr>
<td>112</td>
<td>NNS</td>
<td>“ok, we’re to switch to french now- i apologize in advance for my terrible grammar and butchering your language…”</td>
</tr>
<tr>
<td>113</td>
<td>NS</td>
<td>“pas de problem”</td>
</tr>
<tr>
<td>124</td>
<td>NS</td>
<td>“je suis sure que tu parles tres bien”</td>
</tr>
<tr>
<td>125</td>
<td>NNS</td>
<td>“merci mon francais n’est pas tres bien – particulament ma grammaire!”</td>
</tr>
<tr>
<td>126</td>
<td>NNS</td>
<td>“mon anglais n’était pas trop mauvais?”</td>
</tr>
<tr>
<td>127</td>
<td>NS</td>
<td>“oui c’est difficile la grammaire francaise”</td>
</tr>
<tr>
<td>128</td>
<td>NNS</td>
<td>“merci pour les jeunes francais”</td>
</tr>
<tr>
<td>129</td>
<td>NS</td>
<td>“non, c’est tres bien”</td>
</tr>
<tr>
<td>130</td>
<td>NS</td>
<td>“comment on dit le temps passe vite?”</td>
</tr>
<tr>
<td>131</td>
<td>NNS</td>
<td>“pardon?”</td>
</tr>
<tr>
<td>132</td>
<td>NS</td>
<td>“comment on dit: ‘le temps passe vite’ en anglais?”</td>
</tr>
<tr>
<td>133</td>
<td>NNS</td>
<td>“le temps = temps, oui?”</td>
</tr>
<tr>
<td>134</td>
<td>NS</td>
<td>“oui”</td>
</tr>
<tr>
<td>135</td>
<td>NNS</td>
<td>“time passes fast” = c’est directement ou francais a angles, man normalement, on dit “time flies”</td>
</tr>
<tr>
<td>136</td>
<td>NS</td>
<td>“ah ok”</td>
</tr>
<tr>
<td>137</td>
<td>NS</td>
<td>“tes deja venue en france?”</td>
</tr>
<tr>
<td>138</td>
<td>NNS</td>
<td>“oui, j’ai a la vendee en vacance il y a trois annee”</td>
</tr>
</tbody>
</table>

Figure 7: Example of search for contextual meaning

- The <T> NS unit occurs at line 130.
- The NNS fixates 7 times on the <T> for a total duration of 37143ms.
- The NNS then drafts and sends their <I>; line 131.
- They begin drafting “je ne comprends pas” but abandon this when the NS <R> at line 132 appears in the chat box. They fixate on it twice for a total duration of 4705ms.
- Their focus then goes back to an earlier unit at line 122 for a duration of 578ms.
- They draft and send line 133.
- Four further fixations occur at Line 132 for a total duration of 4526ms.
- While they wait for the NS to respond to line 133, a fixation occurs at line 102, an even earlier unit, for a duration of 1715ms.
- The NS unit “oui” at line 134 appears and the NNS proceeds with the drafting and sending of line 135.

The fixations that occur at lines 122 and 102 show that the NNS is searching for contextual meaning to reason about the Trigger sentence. Even when the NS expands upon the Trigger unit in light of the Indicator provided and the NNS sends a confirmation check at line 133, the journey of their gaze exposes the fact that they are still searching for contextual meaning.
This search only ceases when line 134 appears in the chat box and meaning has finally been established.

As the Trigger sentence and the older units at lines 102 and 122 are non-contingent and are realised across the language transition from English to French, this had been overlooked in the analysis of the output logs, only then acknowledged when analysis of this routine in ELAN took place.

Searching for contextual meaning is a reoccurring feature in the data as a whole. This strengthens the claim that eye tracker data is a richer if not a crucial data source in the analysis of any SCMC environment.

Furthermore, because of disrupted turn adjacency in SCMC environments, as outlined in Section 2.3, what is actually seen and when it is seen seems key in understanding the NNS's orientation to the chat at the level of discourse and, in particular, to their own second language production in the negotiation routines that they engage in. Output logs alone simply do not account for the multi-linear nature of SCMC environments.

**Misidentification of Recasts**

The keystroke data recorded by the eye tracker software is next to near as important as the gaze and fixation data itself. Keystroke data proved especially useful in the process of accurately identifying recasts. In fact, in the example illustrated in Figure 8, line 51 had been identified in the output log as a recast for the Trigger at line 49. Lines 56 and 60 had consequently been annotated as successful uptake of the recast by the NNS.

46   NS - tu as des frères et sœurs?
47   NNS - mais mon prof était très mauvais
48   NS - frères
49   NNS - oui j'ai un sœur et deux frères
50   NS - tu as de la chance j'aimerais bien avoir une grande famille commençait
51   NS - je n'ai qu'une sœur
52   NS - es-tu la plus âgée
53   NNS - j'aime une grande famille
54   NS - la plus grande, la plus vieille
55   NS - moi aussi
56   NNS - non ma sœur elle a trente ans et mes frères a vingt six et vingt neuf
57   NS - ou est-ce que tu habites?
58   NS - donc tu es la plus jeune, la petite dernière
59   NNS - oui c'est fantastique
60   NNS - ma sœur elle habite a London

Figure 8: Misidentification of Recasts
On the basis of turn adjacency, as it is represented in output logs, this seems legitimate. However, on closer inspection of the keystroke data in ELAN, it was found that before the recast in line 41 appeared in the chat box, the NNS had already begun drafting “ma soeur...” with the correct gender for the possessive determiner.

This suggests that the omission of the ‘e’ in line 49 may simply have been a typo. Line 54; “une grand famille”, though gender-agreement problematic also, shows, at least, that the NNS is capable of performing a feminine gender agreement on an indefinite article and thus, if aware that the noun ‘soeur’ is feminine (implied by production of “ma soeur”), then should also be able to perform the agreement for the indefinite article.

Likewise, the error produced in line 53 shows that before drafting “une grand famille”, the NNS fixated twice on the NS model in line 50; “une grande famille”, then averted their attention to the draft box. The keystroke data shows that the NNS user typed “u n e g r a n e”, looked up, paused and then deleted the ‘Space’ and the ‘e’ and typed ‘d’ followed by “f a m i l l e” producing “une grand famille”. This suggests that it may also have been a typo and that, even though a fixation occurs on “la plus grande...” at line 54 for a duration of 1595ms, it may not be perceived as correctional feedback by the NNS.

4.1.2 Adaptation of the Model for Negotiation Routines

Analysing negotiation routines using eye tracker data also shed light on the necessity for a ‘Negotiation Routine’ model that accommodated the specifics of SCMC interaction. The negotiation routine model presented in Section 3.3.2 is the adapted model.

I discovered, at a late stage, that some work had already been carried out on this. Smith [2003a] proposed an adapted and expanded model of Varonis and Gass [1985] for SCMC environments. However, this adaptation was based on a task-based interaction between NNS-NNS dyads. He concluded that even the type of task assigned to the users affected the negotiation routines generated. So, accordingly there was room for a more tailored model to suit the current study.

In addition, there are indications in the eye tracker data such as the time of message transmission and gaze and fixation patterns that suggest that the model for negotiation routines is not always experienced in the same linear fashion by SCMC users.

This was the case in Figure 9 where the Indicator at line 196 for the Trigger at line 194 appears just seconds after a Response at line 195 and is then followed by the NS Response.

This is shown in the time aligned annotated tiers in Figure 10. The NNS showed their orientation to this as no attempt to respond to the indicator was subsequently made. Therefore, it was found that a more flexible model that accounted for more than just a linear mapping from Trigger to Indicator to Response to Reaction to Response was needed.
Figure 9: Disrupted turn adjacency in Negotiation Routine Model

Figure 10: Rapid succession of turns shown in ELAN Timeline

Smith [2003a] built on the Reaction to Response component to expand the original model. This was in an attempt to cater for everything that followed on from the Reaction to a Response component in SCMC that differed from the order delineated in the model derived for oral communication. However, this model seemed to branch off into a labyrinth of different eventualities which, despite its detail, still did not account for some negotiation routine patterns.

Therefore, I found it more appealing to create a model that only dealt with the original four components; Trigger, Indicator, Response and Reaction to Response, adapting it to allow for recursion of the Response component.

As Response is the component which is understood as responding to a signal of misunderstanding or making further clarification requests, a Response in response to a Response conforms to this definition!

A Reaction to a Response is an optional component, a final seal on the routine. Remaining loyal to this definition, the model used in this study encodes Reaction to Response as an exiting mechanism. It only ever occurs once in any routine when meaning has been established and the user wants to ‘pop up’ from the routine. Users perform a Reaction to a Response by providing final minimal feedback in the form of “ok”, “yes/no”, “cool” or emoticons.
This is, however, subject to the disrupted order of SCMC sessions as previously mentioned. If the Reaction to Response is not seen before another Response is sent then it may be that the overall order is $<T>-<I>-<R>*$-$<RR>-<R>$.

4.1.3 Differences in Individual User Behaviours

Where correctional feedback could have been offered and was absent, eye tracker data shows how personal choice and individual user tendencies played an important role in determining what was seen by users and, eventually, what was acted upon.

In Figure 11, eye tracker data exposed the fact that the NNS viewed the clarification request made at line 39 and again at line 44, yet no direct attempt to address the NS non-understanding was made by the NNS. This negotiation for meaning was triggered most likely by the grammatical error (“en” + place that is not a country) made at line 37. The NNS Response at line 42 encodes her surprise (capital letters and an exclamation functioning as paralinguistic cues in SCMC).

Figure 11: Example of individual differences in attending to the chat

The NS’s return at line 44 shows that she is still in the dark and requests further clarification. The NNS acknowledges this in her subsequent gaze and fixations but seems to be trying to decipher indirectly, in her questions at lines 46 & 47, why the NS does not know what “Tipperary” is, especially since it was the NS who had mentioned “Cashel” in the first place!
When the NS responds negatively (lines 49 & 50) to these questions, the NNS exits with ‘Bien’ and attempts to ‘pop up’ from the routine with her unit at line 54 functioning as a Conversational Continuant. At this point, the NNS may feel that it is too late to provide an explanation. The constraints of the medium may have played a part in this, in that the NNS user may be trying to maintain an overall coherent flow in the chat while also yielding to the temporal pressures of SCMC environments as outlined in Section 2.3.

It is interesting to note that these user tendencies are linguistically manifest also. The NSs provided an average amount of recasts (2-3) to most NNS. The NNSs who made more basic grammatical errors received the same amount of recasts as those who made considerably less mistakes. In these cases, the NS may have felt that to do so would disrupt the flow of the chat too much. This notion is elaborated upon further in Section 4.4.

4.2 Language Learning Tendencies in SCMC

In the previous section of this paper I attempted to show how informative the eye tracker data can be in analysing the cognitive processes of a SCMC user in order to describe their user tendencies within Negotiation Routines. Now that a few general patterns have emerged, a closer look at language learning opportunities within SCMC environments is warranted.

The second research question proposed in Section 3.1.1 was:

2. Does Eye tracker data expose any language learning tendencies (noticing and focus on form) in this medium of communication?
Do the patterns in user behaviour in negotiation routines reflect the general SLA Interactionist claims; noticing of input cognitive comparison between IL and TL modified output?

The data in this study shows that NNSs are heavily influenced by NS productions in SCMC environments. In some sessions the pedagogical implications mentioned in Section 3.1 were explicitly alluded to;

“excuse moi je rectifie quand je me trompe je ne voudrais pas te mettre des fautes d orthographe dans la tete”

and corrections of simple typos were made on a general basis, so as to avoid erroneous NS input being supplied to the NNS. The NNS users showed their orientation to this also by their own self-repair techniques. Typos and verb inflection errors such as ‘mor’(‘mot’), ‘tu est’(‘tu es’) and ‘pense-tu’(‘pensest-tu’) were repaired almost immediately in a lot of cases.

In NS-NNS dyads where the NNS was of a higher proficiency level; NS partners were more likely to abbreviate forms. Forms such as ‘c’est’ were contracted to ‘c’ and ‘je’ to ‘g’ etc.

---

NS - “Sorry, I’ll correct any mistakes I make, I don’t want to teach you bad spelling”
An example of this is shown in Figure 12:

```
217  NS -"ok"
218  NS -"je disais grenoble c pas connu pour etre interressant"
219  NNS -"oui"
220  NS -"mais c bien"
221  NNS -";)"
222  NS -"je critique pas"
```

Figure 12: Contraction of forms in French

When line 218 appears in the chat box, the NNS subsequently fixates twice on the ‘c’ for durations of 738ms and 658ms. However, when line 220 appears, no targeted fixations occur on the ‘c’. Later in the same chat session the NS states:

“\textit{mais tu parles mieux que la plupart des irlandais que g rencontre}”

using the contraction ‘g’ in a sentence which in itself exemplifies their confidence to do so.

In studies outlining the benefits of SCMC environments for SLA, most of the comparisons have been made with oral communication. As mentioned in Section 2.1, this is due to the conceptualisation of SCMC sessions as real-time conversations.

Arguments for the benefits of SCMC for language learning rely mainly on the visual saliency that the medium affords. Pellettieri [2000] stated that SCMC “fosters focus on form”. But this visual saliency can swing both in favour of and against language learning, as was made clear by the data collected in this study.

4.2.1 Typographical Errors

Although Berglund [2009] claims typos do not cause confusion for users in NS-NS dyads, the eye tracker data suggests otherwise, at least for NS-NNS pairs. Typos that occurred in NS output such as “anque” and “les bombons” that initiated a negotiation routine and restricted the accessibility of a recast respectively in SCMC would not have done so in oral communication (except if the NS made a drastic error in pronunciation).

Conversely, erroneous forms in NS productions such as “le mieu”, that may have been the result of a typo or simply an abbreviated form, and that engendered numerous repetitions in NNS output, otherwise phonetically indistinguishable, would not have lead to NNS reproduction of an incorrect model in oral communication to the same effect as it did in SCMC.

\textsuperscript{8}“you speak better than most Irish people I’ve met”
 Component | # Fixations | Total duration
---|---|---
T | 3 | 15192ms
T (w/D) | 1 | 857ms
T | 2 | 3868ms
I | 1 | 3469ms
R | 1 | 2153ms
RR | 1 | 1296ms
T | 2 | 7277ms

Table 2: Example of 'anque'

The contexts for these three occurrences are shown in Figures 13-15. In Figure 13 the negotiation routine for ‘anque’ is shown.

Table 2 above shows an account of the fixation patterns from the eye tracker data.

The following is a descriptive account of the unfolding of events.

- The user fixated 3 times on the Trigger(T) before drafting a response for a total duration of 15192ms.
- Fixating again on T while drafting her indicator for 857ms.
- She sends her Indicator(I). Two further fixations occur on the Trigger(T) for a total of 3868ms.
- She then fixates on her Indicator(I) for 3469ms. The Response(R) at line 67 appears and this engenders a fixation of 2153ms.
- The NNS posts a Reaction to Response(RR) at line 69 and fixates on it for 1296ms. She then fixates a further two times on the Trigger(T) for a total duration of 7277ms.

In this example it seems as though, because the user fixated just once on the Response for a duration of 2153ms and did not indicate any further non-understanding, they were already familiar with the verb ‘manquer’.
This implies that the typo ‘anque’ made at line 64 entered both users into an unnecessary negotiation routine. To this effect, it appeared as though nothing was gained in the way of language learning and, instead, confusion was caused and chatting time lost.

In Figure 14 the example containing the typo ‘les bombons’ is shown. Table 3 above shows Fixation data. This was a more complex example in which two negotiation routines (one negotiation of meaning and one negotiation of form) were running simultaneously.

A negotiation of form routine is indicated by Trigger(1) Indicator(1) Response(1). It is the Indicator(1) at line 252 that provides a recast to “aimer des bonbons” by providing “les bombons”. The typo made in the Indicator(1) “bombons” distracts the NNS. Indicator(2) as an echo of Trigger(2), also demands more attention of the NS and these two factors conjointly render the recast less accessible.
The following is an interpretation of the data:

- The user fixates twice on the Indicator. The second time they do so while drafting “oui” so this suggests that they are negotiating meaning and not form.

- The response at line 254 appears and the NS abandons their current draft.

- They fixate once more on the Indicator for 817ms.

- They then revert their attention to the Response at 254 and send their own Response(255) while other NS unit at 256 appears.

- They focus on their own Response line 255.

- There is a lapse of time (90200ms) while the other topic thread develops and then the NS looks back to the Trigger at line 249 for 3309ms and in and around lines 254 & 255 for a further 2173ms.

These last two fixations imply that the NS still wants feedback for their Clarification Request at line 255. This is never provided.

So while interaction within negotiation routines in SCMC is beneficial to SLA as argued in Pellettieri [2000], Smith [2003b], it can also be counterproductive when SCMC variables such as typographical errors are present.

### 4.2.2 NS influence

In a similarly complex Negotiation Routine that features in a different chat session, the erroneous form “mieu” in a NS production elicits numerous extended fixations from the NNS and leads to their own uptake of the erroneous form. This is illustrated in Figure 15.

The pattern of fixations on the form ‘le mieu’ following the erroneous model provided by the NS at line 224 may suggest that the user is reasoning about the well-formedness of the noun. Their uptake of the erroneous form shows evidence for the influential role that NSs play in NS-NNS chat dyads previously mentioned. Yet, the NS does not seem entirely convinced as numerous further fixations occur targeting “le mieu” in their own unit containing the uptake at lines 228 & 232.

An interpretation of the fixation data is provided in Table 4 on the next page:

However, this example is not so straight forward. Although there are numerous fixations on the form “le mieu”, it is important to note that “le mieu” is in fact the comparative referent under negotiation in the two negotiation routines which unravel subsequently; the confusion being whether it refers to universities or areas in France.
<table>
<thead>
<tr>
<th>Component</th>
<th>Duration of Fixation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>2652ms</td>
<td>near “le mieu”</td>
</tr>
<tr>
<td>M</td>
<td>2053ms</td>
<td>on “le mieu”</td>
</tr>
<tr>
<td>M</td>
<td>777ms</td>
<td>on “le mieu”</td>
</tr>
<tr>
<td>M</td>
<td>977ms</td>
<td>on “le mieu”</td>
</tr>
<tr>
<td>Begins Drafting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D/U</td>
<td>2253ms</td>
<td>drafting of “le mieu”</td>
</tr>
<tr>
<td>Post-Send monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>1376ms</td>
<td>on “selon toi?”</td>
</tr>
<tr>
<td>T1</td>
<td>1156ms</td>
<td>on “quoi le mieu”</td>
</tr>
<tr>
<td>T1 - II</td>
<td>1176ms</td>
<td>on “le mieu” as NEW NS unit appears “à l’université”</td>
</tr>
<tr>
<td>T1,II</td>
<td>321</td>
<td>between “le mieu” and NS unit appears “à l’université”</td>
</tr>
<tr>
<td>T1</td>
<td>2013ms</td>
<td>on “le mieu”</td>
</tr>
<tr>
<td>T1</td>
<td>2372ms</td>
<td>on “le mieu”</td>
</tr>
<tr>
<td>T2</td>
<td>1635ms</td>
<td>Central fixation (perhaps overall recap)</td>
</tr>
<tr>
<td>T1</td>
<td>0817ms</td>
<td>on “le mieu”</td>
</tr>
<tr>
<td>T1</td>
<td>1914ms</td>
<td>NS unit “à l’université”</td>
</tr>
<tr>
<td>R1</td>
<td>1116ms</td>
<td>New NS unit “matiere”</td>
</tr>
<tr>
<td>T1</td>
<td>1017ms</td>
<td>NS unit “à l’université”</td>
</tr>
<tr>
<td>M</td>
<td>0797ms</td>
<td>near “le mieu”</td>
</tr>
<tr>
<td>M</td>
<td>1017ms</td>
<td>Gaze from “vu” to fixation on “le mieu”</td>
</tr>
<tr>
<td>T1</td>
<td>0778ms</td>
<td>on “selon toi?” while drafting</td>
</tr>
<tr>
<td>M-D</td>
<td>1037ms</td>
<td>Gaze from “le mieu” to fixation on draft</td>
</tr>
<tr>
<td></td>
<td>0738ms</td>
<td>Central fixation close to “le mieu” while drafting</td>
</tr>
<tr>
<td>D</td>
<td>0698ms</td>
<td>Draft of “le mieu”</td>
</tr>
<tr>
<td>D</td>
<td>1535ms</td>
<td>production of “le mieu en France”</td>
</tr>
<tr>
<td>T2</td>
<td>2293ms</td>
<td>on “quoi le mieu”</td>
</tr>
<tr>
<td>R2</td>
<td>1495ms</td>
<td>NEW NS unit as it appears and deletes entire draft</td>
</tr>
<tr>
<td>R2</td>
<td>1416ms</td>
<td>new NS unit “à visiter”</td>
</tr>
<tr>
<td>R2</td>
<td>0937ms</td>
<td>new NS unit “à visiter”</td>
</tr>
<tr>
<td>R2</td>
<td>1396ms</td>
<td>“ben le sud, paris, la bretagne”</td>
</tr>
</tbody>
</table>

Table 4: Example of ‘mieu’
It is examples like this that may warrant additional data sources to avoid speculation. In this case perhaps having access to a stimulated recall from the NNS of the chat session would have clarified if the user’s fixations were due to reservations about the well-formedness of “le mieu” or related to the overall negotiation of meaning that was taking place.

Interestingly enough, the correct form was produced by the NS user later on in the chat at line 356. The NNS fixated once directly on “mieux” (1615ms), a second time near to the form (638ms) and the third time on “tu parles mieux” (1595ms). No further uptake was made, so aside from the curious reoccurrence of targeted focus on the correct form “mieux”, one can only speculate about whether the NS actually noticed the correct form and made a cognitive comparison with the earlier erroneous form “mieu”. Variables such as working memory may be at play here but regrettably the current data did not take a measure for it.
4.3 To Quantify ‘Noticing’

In the previous section some issues pertaining to the contextual setting of the negotiated forms highlighted some uncertainties in mapping user gaze and fixations to what they are actually ‘noticing’. In this section I try to quantify ‘noticing’ in terms of what was presented in the eye tracker data set where explicit uptake was contingent to forms of correctional feedback provided.

As outlined in Section 2.2.1 there has been much debate about what constitutes ‘noticing’ since its inception in 1990. The techniques mentioned in Section 2.1.1 have been used to measure ‘noticing’ in SCMC but conclusions have been far from convincing.

Eye tracking software shows more promise in working towards a formal definition of ‘noticing’ and defining its cognitive correlates. To my knowledge, there have only been two studies conducted to date that have use eye tracker data to describe different aspects of SCMC environments; Smith [2010] and O’Rourke [2008], the later of which was based on the same data set as this study. Therefore, ‘noticing’ is a concept that remains unclear in SCMC.

Smith [2010] measured noticing as any fixation greater than 500ms. He outlined concerns about the validity of this convention in the limitations of his study:

“though not arbitrary, the cut off length of 500 ms for considering a fixation as evidence of noticing may be too short or too long”

He also mentioned that eye tracker data analysed in conjunction with think-aloud protocols and stimulated recalls may be key in refining this cut off point.

Admittedly, incorporation of these methods into a study of SCMC seems necessary to properly quantify ‘noticing’ in SCMC, as has already been established in Section 2.2.1. How and ever, to get closer to an estimation of the types and duration of gaze, as well as accounting for the other factors that ‘noticing’ might require, it seemed worthwhile to analyse any occurrences where there was explicit immediate uptake of correctional feedback, contrasting both implicit and explicit examples.

4.3.1 Noticing of Implicit Correctional Feedback

Where implicit correctional feedback occurred in the form of recasts the following was discovered.

Figure 16 shows a negotiation routine in which a recast was provided to the NNS at line 248 and their response was explicit uptake of the recast even employing capital letters to highlight this. The fixation patterns for this routine are documented in the table below.

Upon analysing the fixation data for this example, it became clear that it may be possible to measure variables such as ‘readiness’ using eye tracker data and that this may be crucial in refining the concept of ‘noticing’ in SCMC.
Table 5: Example of ‘université’

<table>
<thead>
<tr>
<th>Component</th>
<th>Duration of Fixation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drafting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T / D</td>
<td>1.116</td>
<td>“d’un”</td>
</tr>
<tr>
<td>T / D</td>
<td>0.817</td>
<td>“d’un” and deletes ‘un while fixating then retypes</td>
</tr>
<tr>
<td>T / D</td>
<td>2.014</td>
<td>“d’un” and then deletes d’un while fixating.</td>
</tr>
<tr>
<td>T / D</td>
<td>0.598</td>
<td>as retypes d’un</td>
</tr>
<tr>
<td>Post-send</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.698</td>
<td>on erroneous “d’un université”</td>
</tr>
<tr>
<td>T / D</td>
<td>1.555</td>
<td>on “université” -&gt; 2nd NS unit appears with recast “d’une université”</td>
</tr>
<tr>
<td>O-R</td>
<td>4.227</td>
<td>on recast while drafting</td>
</tr>
<tr>
<td>O</td>
<td>1.595</td>
<td>on 3rd send unit - own unit appears</td>
</tr>
<tr>
<td>R</td>
<td>0.618</td>
<td>on “à l’université”</td>
</tr>
<tr>
<td>R</td>
<td>1.814</td>
<td>on “UNE université”</td>
</tr>
<tr>
<td>O</td>
<td>1.156</td>
<td>on “UNE”</td>
</tr>
<tr>
<td>T</td>
<td>1.136</td>
<td>on “à l’université”</td>
</tr>
<tr>
<td>O</td>
<td>1.356</td>
<td>on “à l’université”</td>
</tr>
</tbody>
</table>

The fixations and deletions that occurred during the drafting period of “d’un” coupled with one further fixation on the error post-send imply that the user had reservations about the well-formedness of their output. This pattern in simultaneous and post-send monitoring suggests that their awareness has been activated. They are in ‘prime noticing condition’ and ready for correctional feedback.

In this case the recast provided is contingent and a single standing unit in which the NS used ellipsis in responding to the question at line 246. The actual fixation data indicated frequent fixations greater than 1000ms on both the recast and the NNS’s own response containing the explicit uptake as well as on the neighbouring form “à l’université”.

The evidence of user ‘readiness’ seems to render the imposition of a cut-off point on fixation data unnecessary. It even suggests that mere saccades could be indicative of ‘noticing’ depending on the user’s readiness and, that if the user simply isn’t ready or their awareness has not yet been activated, no amount of fixating on or near non-target like forms is indicative of them ‘noticing’ their errors.
The activation of awareness at this point entails two conditions. The first is the global condition that relates to one of the concepts mentioned in Section 2.2.1 which states that the user has a current lexical and grammatical model of the language; and as was discovered by Philp [2003];

“learners reject input that cannot be interpreted in terms of current knowledge”.

This accounted for the results of many studies which showed that learners were more inclined to notice lexical recasts than those that made adjustments to morphosyntax.

In this example, the NNS knows nouns are gender specific in French and that the indefinite article must agree with the gender of the noun and they are, perhaps, also generally aware that this distinction forms a fundamental part of French grammar.

What the NNS is unsure of in this case, is what the gender of ‘université’ actually is and this ‘uncertainty’ means that the second condition in the activation of awareness is met.

To strengthen this claim, further contrasts can be made with examples where users do not meet global condition and thus are blocked at the second condition, because ‘uncertainty’ simply never occurs despite any prolonged and frequent fixations that may be in evidence.

In Figure 17 the NNS consistently produces the error “beaucoup des..” throughout the session. It can be inferred that they are not familiar with the grammatical rule “beaucoup de” (unspecific referent).

<table>
<thead>
<tr>
<th>Component</th>
<th>Duration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>7102</td>
<td>Rough duration as recast appears during draft fixation</td>
</tr>
<tr>
<td>I/D</td>
<td>1356</td>
<td>on “de grandes ville” but drafts beaucoup des....</td>
</tr>
<tr>
<td>I/D</td>
<td>1057</td>
<td>on “de grandes ville” direct copy does not agree plural</td>
</tr>
<tr>
<td>R</td>
<td>3469</td>
<td>on “des grandes ville”</td>
</tr>
<tr>
<td>I</td>
<td>8912</td>
<td>on “de grandes ville”</td>
</tr>
</tbody>
</table>

Table 6: Example of ’de grandes ville’

---

37
Within the negotiation routine a model form is supplied by the NS with a recast encoded. The model uses a different quantifier; “plus de” so it is not a direct mapping. However, the error made at line 196 in the recast (“ville” not showing plurality) is copied directly by NNS showing the attention that was paid by the NNS in reproducing this form. This is reflected in the fixation data in Table 6 above. The NNS fixates on the indicator twice for 1356ms and 1057ms respectively while drafting their response (line 197). However, they still draft ‘des’ but copy “grandes ville” with plurality agreement error intact.

This routine takes place towards the end of the chat session and funnily enough, just before the chat terminates, the NNS does fixate two more times on their own response and then on the indicator specifically on the “de” in line 196 for 8912ms. This does not, however, weaken the claim being made, in that at the crucial time of uptake the correct form was not replicated at line 197. Furthermore, it may just have been a case of idle browsing given that the NNS expects, at most, a closing message from the NS.

4.3.2 Noticing of Explicit Correctional Feedback

In Figure 18, an example of overt correction is shown. The fixation data is supplied in Table 7 above.

In this example, the second condition in the activation of awareness is not signalled by the eye tracker data. The NNS does not hesitate while drafting “le sent” nor does she fixate on it post-send. When the Indicator appears in the chat box she fixates it twice while drafting her own unit at line 170 and then again once line 170 has been sent. This amounted to a total duration of 5912ms of fixation. Drafting of the explicit uptake at line 171 begins and this is fixated twice for total duration of 2253ms. Following this, two further fixations occur on the overt correction at line 169 totalling at 3090ms.

Figure 18: Noticing of Explicit Correctional Feedback

In this example, the second condition in the activation of awareness is not signalled by the eye tracker data. The NNS does not hesitate while drafting “le sent” nor does she fixate on it post-send. When the Indicator appears in the chat box she fixates it twice while drafting her own unit at line 170 and then again once line 170 has been sent. This amounted to a total duration of 5912ms of fixation. Drafting of the explicit uptake at line 171 begins and this is fixated twice for total duration of 2253ms. Following this, two further fixations occur on the overt correction at line 169 totalling at 3090ms.
This seems to suggest that the second condition in the activation of awareness may only be necessary to notice input that is implicit in nature, i.e. recasts. One can easily understand why this may be the case. It would be hard not to notice’ errors when feedback explicitly draws attention to them, in this case by using “on dit…”.

However, the global condition remains; the NNS must be aware that a lexical item “l’odeur” exists or at least must able to deduce its meaning from the context by making a cognitive comparison with the Trigger “le sent”, or by first mapping it to L1 knowledge “odour” in English and then making the link with the Trigger.

If this global condition were not met, the non-contingency of the Trigger at line 163 and the Indicator at line 169 may well have initiated another negotiation of meaning triggered by the noun “l’odeur”.

Some cases of overt correction that engendered no explicit uptake showed similar patterns. In Figure 19 there are two ‘active’ negotiation routines:

17. NNS: j’avais per ma frangais TRIGGER[1] (“portuguese”)
18. NS: je peut apprendre a dire longtemps on est un brigado pour les hommes et abrigado pour les femmes
19. NNS: mais maintenant je souhaite parler mes frangais
20. NS: il faut tenir en France ce que tu rencontres des frangais
21. NS: je cours que le mercredi et te fais au dudel il devient pour que les frangais rencontrent des frangais
22. NS: et ce que tu études les frangais ou autre chose INDICATOR[1] (“etudier le frangais”)
23. NS: portugais est portugais en frangais RESPONSE[1] (no-uptake of studying frangais)
24. NS: l’étude frangais a été pour six ans mais je ne parle frangais et maintenant étude frangais est RESPONSE[1] (no-uptake of studying frangais)

Figure 19: Noticing of Explicit Correctional Feedback

The first refers to T(1)-I(1)-R(1) which is a negotiation of form. The NNS uses a feminine determiner at line 16 and omits and definite article in subsequent verb phrases such as “parler le frangais”, “etudier le frangais”. An Indicator for this is provided at line 36 and subsequent fixations show that the user focuses in particular on the units “etudies” and “le frangais”. Fixation data is shown in Table 8 above.

This example reinforces the claims previously made about the global condition being necessary for the second condition in the activation of awareness to be met.
The second negotiation routine, which is what is under discussion here, is indicated by T(2)-I(2) and was initiated by the NNS code switch at line 30 “portuguese”, which is typical in tandem chat sessions where users employ their L1 to fill in the gaps in their L2 vocabulary. Kotter [2003]

Fixation data (represented in Table 9 above) shows 5 subsequent fixations on the I(2) at line 37 for a total duration of 9589ms. The user then looks back to the Trigger at line 30, their gaze goes to line 36 with a focus on “études” and they revert their attention to the trigger at line 30 fixating it for 1954ms and then subsequently look back to “portuguais” at line 37.

It is interesting to note that the user’s gaze showed evidence of a ‘cognitive comparison’ between the original error and the correctional feedback despite the fact that the Indicator contains both a repetition of the error (though misspelled) and the overt correction itself.

No explicit uptake is made by the NNS nor is any acknowledgment given such as “ok” or “merci”. Yet, the fixation data shows us precisely to what extent the user focused on these forms. The explicit nature of the feedback entails both the global and second condition in the activation of awareness.
Other instances of explicit correctional feedback were called for by the NNS themselves. These examples were similar to the case of “d’un universite” in that the second condition for activation was met. NNS ‘uncertainty’ was signalled by their hesitations in drafting and also their post-send gaze patterns as well as encoded in the content of their send units.

Two examples are shown in Figures 20.

```
302  NNS - et comment vous accordez TRIGGER ("accordez")
303  NNS - ?? ?? INDICATOR (registers uncertainty)
304  NNS - accordez ?? INDICATOR (explicitly calls for clarity)
305  NNS - c'est fini
306  NS - tres tres bien on a vecu ensemble 2 ans et elle me manque
307  NS - entendez RESPONSE (overt correction provided)
308  NS - d'accord

---
336  NNS - tu vas au bome hier soir? TRIGGER - "bome"
337  NNS - bome? INDICATOR - questioning form by offering alternative
338  NNS - ou bome? INDICATOR - questioning form by offering alternative
339  NNS - je oublie INDICATOR - explicit statement of uncertainty
340  NS - quoi? RESPONSE
341  NS - boite? RESPONSE - suggestion
342  NNS - non boite ca c'est un night club? RESPONSE - not accepted
343  NS - bome... party RESPONSE - code switch
344  NS - oui RESPONSE - accepted
345  NS - fete RESPONSE - proposal
346  NNS - fete RESPONSE - accepted
347  NS - oui RESPONSE
348  NNS - oui j'ai été REACTION TO RESPONSE - meaning established NNS tries to move on
349  NNS - c'est ca aussi RESPONSE
350  NS - boilem un peu et je suis rentree
351  NNS - mais est ce qu'il y a un mot bome? INDICATOR - further clarification request
352  NNS - ou quelque chose comme ca? INDICATOR - registers uncertainty
353  NNS - non? INDICATOR - uncertainty shown
354  NS - ou bome RESPONSE
355  NNS - ouioui REACTION TO RESPONSE
356  NNS - ca REACTION TO RESPONSE
357  NNS - bine RESPONSE
```

Figure 20: Examples of NNS requesting correctional feedback

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4.4 Recasts

The previous section was concerned with quantifying the concept of ‘noticing’ in SCMC. Access to eye tracker data in this study has enabled a clearer insight into the different variables that may be key in refining what actually constitutes ‘noticing’ in SCMC. Equipped with more insight into the fundamentals of ‘noticing’, we can then analyse in detail aspects of SLA in SCMC such as recasts using the eye tracker data to guide our intuitions about other variables that may be playing a part in the interaction.

The third and final research question for this study was:

3. Finally, where corrective feedback is supplied, specifically Recasts, is it possible to account for why, when and how they are given and received in SCMC?

As I have already dealt with many occurrences of recasts in previous examples to show trends in user behaviours and language learning tendencies, the results discussed in this section try to paint a general picture of the data on a whole. The results are qualitative and not quantitative in this case, as the total number of recasts found in 12 chat sessions only totalled at 24, 66.67% of which were grammatical and 33.33% lexical.

Lexical recasts that corrected minor orthographical mistakes were fixated and successfully reproduced in output in two cases from different sessions illustrated in Figure 21.

One other case showed numerous fixations on the recast “la grammaire” before and while drafting but subsequent output still contained the Trigger error: “ma gramaire” This same NNS did, however, successfully reproduce the lexical recast “grandes ville” from their non-target like “cites” in output following the Indicator as was seen in Figure 17 above.

In Figure 22, the grammatical recast that encoded a subtle change to the Trigger in gender agreements on nouns was not focused on by an NNS who had shown consistent attention to form in the rest of their chat. (Example in Figure 16 above).

However, another user did focus just once (5263ms) on the recast “à Galway” and changed from their current “en + place that is not a country” construction to the correct “à + place that is not a country” for the remainder of the chat. This is shown in Example One of Figure 23.

Line 37 was the Trigger for a negotiation routine seen in Figure 11 above. The fact that the NNS did not fixate this form at that point in time suggests that the the second condition of activation was not met; NNS ‘uncertainty’.
Figure 21: Example uptake of subtle lexical Recasts

204 NS: "Il faut travailler plus tout seul ici!"
205 NNS: "Et tu es bien content ici?" TRIGGER- "(content_)
206 NS: "Et aller à la bibliothèque!"
207 NNS: "Tu es toujours contente?" INDICATOR- "(content_)
208 NS: "C'est une change de pays!"

Example One

77. NNS - cashel est en tipperary TRIGGER- "(en_" Tipperary")
78. NS: oui, j'ai aussi été à Galway rapidement mais j'avais pas le temps jadis y retourner INDICATOR- "(a Galway")
79. NNS - et Irlande de Dublin en plus (non-contingent RESPONSE- "à Dublin")
80. NS: je suis allez à Howth Malahide Dan Laoghaire mocher Glendaugh (Further model example)
81. NNS: Que pens tu des pubs à dublin? (more successful uptake)
82. NNS - vais au petit villages etc à Wicklow (more successful uptake)

Example Two

10. NNS - Tu fais ERASMUS en Trinity? ERROR- "en Trinity!"
15. NNS - la deuxième fois j'étais à Cannes ERROR- "en Cannes"
48. NS- si tu n'aimes pas la compagnie, tu pourrais virer à Paris sans problème, MODEL (correct contingent Form)
51. NNS - oui, je voudrais vivre à Paris TRIGGER- "en Paris!")
56. NS- alors studier à Paris pendant deux ans çà m'a fait un choc... où Jesus le depuis le mois de juillet INDICATOR- "à Paris"

Figure 22: No noticing of subtle gender agreement Recast

Figure 23: En/à - grammatical
In Example Two of Figure 23, a different NNS user fails to model their output at line 51 on a contingent correct form supplied by the NS at line 48. The subsequent recast at line 56 is not fixated. No further constructions of this type feature in the chat session. The fixation data for this particular chat session was sporadic and fixations were not as frequent as in other sessions. This suggests that this NNS was a non-touch typist. It also shows how they failed to model other patterns in the language such as “avoir +age” and how no correctional feedback was offered by the NS to rectify this.

Fixations occurred on two non-contingent recasts in this data set. Neither NNS used these forms in subsequent output. One example is in Figure 19 above (“ma francais” - “le francais”) and the other is shown below in Figure 24 (“concentre sur” - “me concentre sur”).

As was outlined in Section 4.1.3, there was an average of 2-3 recasts being provided by NSs in every session. Yet, the variance in the amount of lexical and grammatical mistakes made by NNS users therein differed substantially. Table 10 above shows the recasts given by one NS partner. The lower the proficiency level of the NNS, the less likely they were to receive implicit correctional feedback for all of their errors.

One could reason about why this is so. More proficient users naturally make less mistakes while consistent correction of less proficient users would disrupt the flow of the conversation. This theory is at least admissible in accounting for the frequency of recasts in NS-NNS non-task based SCMC environments.

Elsewhere, other factors such as being a non-touch typist add a further restriction on the scope for language learning in SCMC. The time spent looking at the keyboard naturally takes from the time spent observing what is happening and when it is happening on the screen. This data confirms that individual differences in terms of typing ability do have a negative effect on the benefits of a SCMC environment for SLA.
<table>
<thead>
<tr>
<th>Component</th>
<th>Duration of Fixation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>3.549</td>
<td>new NS unit appears and on recast &quot;des nouveaux amis&quot;</td>
</tr>
<tr>
<td>I/D</td>
<td>0.397</td>
<td>on &quot;nouveaux amis&quot; recast while drafting</td>
</tr>
<tr>
<td>I</td>
<td>-</td>
<td>reads &quot;nouveaux amis&quot;</td>
</tr>
<tr>
<td>D</td>
<td>2.791</td>
<td>on &quot;des personnes nouveaux&quot; current draft</td>
</tr>
<tr>
<td>D</td>
<td>3.09</td>
<td>on &quot;des personnes nouveaux&quot; current draft</td>
</tr>
<tr>
<td>D</td>
<td>6.639</td>
<td>on &quot;des personnes nouveaux&quot; current draft and deletes &quot;nouveaux&quot;</td>
</tr>
<tr>
<td>D</td>
<td>2.093</td>
<td>while navigating left and inputing &quot;nouveaux&quot; in pre-nominal position</td>
</tr>
<tr>
<td>D</td>
<td>1.316</td>
<td>as drafting &quot;nouveaux amis&quot; in current draft</td>
</tr>
<tr>
<td>R</td>
<td>1.097</td>
<td>on own send unit on &quot;nouveaux personnes&quot;</td>
</tr>
<tr>
<td>I</td>
<td>0.638</td>
<td>on NS unit with recast &quot;nouveaux amis&quot;</td>
</tr>
</tbody>
</table>

Table 11: Example of 'nouveaux amis'

Other observations made while viewing the eye tracker data raised some interesting questions about the application of recasts to different forms. This is illustrated in the example seen in Figure 25 below. Table 10 with fixation data is shown above.

Figure 25: Application of Recast to different forms

The NNS applies the recast supplied by the NS at line 160 to their production at line 161 of “nouveaux personnes”. Although the gender is still wrong, this shows promise for the kinds of model matching that can take place in SCMC and due to the visual saliency of the medium.

The current study has a small number of recasts and other forms of corrective feedback which is expected from informal NS-NNS dyads; “metalinguistic focus is lacking...and attempts at overt correction rarely occur” Long [1996]

Although the informal setting of the sessions in this study reflect natural interactions between NS-NNS dyads, the creation of a stricter pedagogical environment by briefing the NS on the provision of correctional feedback, even if the chat sessions were to remain non task-based, may yield richer output data for the purposes of analysing recasts.
4.5 CMDA vs. SLA

The eye tracker data has thus far enabled a clearer understanding of the cognitive processes and behaviours of NNS SCMC users and shown how they attend to their interlocutor’s output as well as to the production of their second language in tandem NS-NNS dyad chat sessions. It has also shown that SCMC environments can sometimes be counterproductive to language learning.

As outlined in Section 2.2.2 in SCMC-SLA research conducted to date, it has been argued that one of the benefits of the medium is that it affords the user longer processing time and thus, the NNS can take more care in focusing on input and producing output.

However to make this claim so vehemently seems perverse especially since Computer Mediated Discourse Analysis (CMDA) suggest that the contrary is, in fact, the case. A general characteristic of SCMC, as CMDAs see it, is that the medium, because of the multi-linearity of topic threads and absence of paralinguistic cues, imposes a temporal pressure on the user. To be a ‘good’ chatter is to be able to keep up to date with multiple threads while ensuring that your current draft will be a relevant and worthwhile contribution at the time of its transmission.

Users show their orientation to this, as has been shown in Beisswenger [2008] who studied the phenomena of users deleting entire drafts when an interlocutor’s unit appears that renders their draft irrelevant.

When assessing the overall ability of an SCMC user, one determining factor is their typing speed. A touch typist will naturally be more at ease in an SCMC environment and will be able to interact efficiently, producing coherent output in this medium of communication. In relation to SLA in SCMC, an additional factor was found to be the NNS’s proficiency level in French. The trend was that the higher the level of proficiency in the language, the more representative of CMDAs claims the user was.

One way in which the temporal pressure imposed was reflected in the fixation data, was the existence of a reoccurring pattern in user tendencies to fixate the “live” area of Chat Box (fixation represented by the blue dot) while approaching the end of their draft. This is illustrated in Figure 26.
Figure 26: User behaviour focusing on ‘live’ area of Chat box while approaching the end of draft

This shows the eagerness of the user for their unit to become live. Motivation for doing this may be to make sure that their current unit has not already been rendered irrelevant before they commit to sending it. This reflects the claim made in CMDA about the pressure that is on SCMC users to keep a coherent flow in the chat and how they cannot afford to take too much time in producing their output.

There was a correlation between the slower paced chat sessions and lower proficiency levels in French. Some users explicitly stated that they would be ‘slower’ in French or requested longer processing times.

- NNS - “alors, breffni dis qu’on doit parler en francais maintenant”...“donc je serai beaucoup moins vite ;)”\(^9\)
- NNS - “le phrase, c’est longue... je dois penser pour un moment, pour les mots a trouver”\(^10\)

NS users adapted to this naturally or else signalled otherwise; as can be seen in Figure 27 where the NS checks if the NNS is still there with an “hello?”.

\(^9\)NNS - “so, breffni said we have to speak in french now...so I will be a lot slower ;)”\(^10\)NNS - “the sentence is long, I have to think for a moment to find the words”
Another NS sent the unit "je suppose que je tape un peu vite"\textsuperscript{11} when a breakdown in communication occurred.

The point being made here is that NNS SCMC users set their own pace in the chat either explicitly or by example so that they could produce output in their own time. This is the kind of environment that is described in SCMC-SLA research. A slower paced chat naturally encourages more reflection and monitoring. This may be the kind of approach needed for accelerated SLA in SCMC environments. The NNSs of a higher proficiency level strived to keep up with their NS partners contributing to an overall faster pace that would be typical of a NS-NS chat session.

Some claims have been made that less proficient language users are more likely to notice recasts cited in Lai et al. [2008]. This may suggest that because more proficient learners maintain a similar pace in SCMC to that of an NS-NS dyad, they are less likely to notice mistakes and recasts as the pace and temporal constraint of the medium simply doesn’t allow it.

\textsuperscript{11} I suppose I’m typing a bit too fast"
5 Conclusion

5.1 The Significance of What Was Found

The results presented above in Section 3 all highlight the merits of using Eye Tracker technology to analyse SCMC environments.

It has been shown that output logs are an insufficient data source when it comes to assessing the real dynamics of SCMC environments. Data collection techniques that measure both the visual and temporal parameters in SCMC are more likely to capture the true nature of this medium of communication and reveal how users orient to it.

The Eye Tracker data exposed the different learner reactions to correctional feedback in Negotiation Routines shown in both the pattern of their gaze and fixation and their subsequent output in the data.

There was evidence in the data that suggested the visuality of input and output in SCMC is conducive to SLA in line with the claims made in Interactionist Theory.

Learners have the possibility to “look back” on older units, revise and monitor their output, “notice the gap” and reuse vocabulary and sentence structures that have been supplied by the NS. O’Rourke [2008]

However, it was equally demonstrated that the visuality of input can be counterproductive to SLA because of the strong influence the NS has on the NNS. This meant that typographical or standard orthographical errors made by the NS that were not subsequently corrected, were likely to be reproduced by the NNS output.

Elsewhere, it was found that Eye Tracker data may help in refining what constitutes ‘noticing’ in SCMC. The additional variable of “readiness” could be measured on the basis of simultaneous, pre-send and post-send monitoring of erroneous forms produced by NNSs.

Where the ‘uncertainty’ that this behaviour reflects was not in evidence, it was shown that user awareness had not been activated. It was thus suggested that there are two conditions to be met for awareness to be activated. The first was that the user must be familiar with the grammatical rule under negotiation or, if not, must be able to infer meaning from the surrounding context or à travers their L1.

Once this condition is met, further activation requires the ‘uncertainty’ of the user about the well-formedness of their current draft. If these conditions are not met, the user is less likely to ‘notice the gap’.

Finally Eye tracker data gave a better insight into the internal workings of negotiation routines and, hence, facilitated the suitable adaptation of the model for oral communication Varonis and Gass [1985] to account for SCMC environments.
5.2 Limitations

As was noted in Section 3 above, there were times when the eye tracker data was difficult to interpret. In complex negotiation routines, the users’ gaze and fixation patterns were ambiguous and one could only speculate about the cognitive processes that were taking place. It became apparent that the retrospective methods outlined in Section 2.1.1 would be useful in resolving ambiguity in these cases.

The Eye Tracker data collected for some of the participants was more accurate than others. Imaginably, as Eye Tracker Technology advances there will be more options made available to researchers to counteract problems in calibration that were encountered in the collection of this data.

Naturally, it would be twice as informative to have eye tracker data for the NS speaker also or, at least, keystroke data so that their send units could be processed automatically. As Negotiation Routines have two place relations in these sessions, a definitive analysis therein could only be made with both NNS and NS eye tracker data at hand.

Finally, in terms of chat interfaces, the MOO that was used is outdated. As was mentioned in Section 2.1, most modern chat systems make interlocutor status available to the user. This would affect the interactional patterns of users.

5.3 Suggestions for Future Work

With the limitations outlined in the previous section in mind, it seems legitimate to suggest that a study combining all modern methods contained in the various studies conducted to date should lead to more conclusive results from which further hypotheses can be made.

It is clear that ‘Noticing’ as a concept needs to be better understood in terms of the resources; such as fixation and gaze data, made available by Eye Tracker technology. Moreover, the classification of learner uptake and storage in Long Term Memory of target-like language needs to be developed to further ground any hypothesis made in relation to language learning in SCMC.
References


Bryan Smith. Employing eye-tracking technology in researching the effectiveness of recasts in CMC. In Francis M. Hult (Ed.), *Directions and prospects for educational linguistic*, pages pg 79–97, 2010.


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Appendix A – List of Figures and Tables

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Tables
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B  Translations
Appendix B – Translations

Figure 6;

3. NNS – I am a member of Players but I don’t do anything with them
4. NNS – do you understand?
5. NS – What do you do with them?
6. NS- Is it games society?
7. NNS – I like theatre, i would like to do a little drama with them
8. NNS – I’m not a good actress but I like acting
9. NS – ah that’s cool, do you do auditions with them sometimes, I saw that there were a lot here.
10. NS – We say “jouer” ; to act
11.NNS – merci
12- NS – and what show are you going to put on? ..... 
25.NS- it was a play in French but it’s mostly visual so there wasn’t a real language barrier.
26- NS are you from Dublin?

Figure 7;

130. NS – how do you say the time passes fast?
131. NNS – sorry?
132. NS – how do you say: “the time passes fast” in English?
133.NNS – time = time, yes?
134. NS – yes
135 NNS – “times passes fast” – it’s direct from French to English but normally we say “time flies”
136 NS - ah ok

Figure 8;

49. NNS – Yes I have one sister and two brothers
51. NS – I only have one sister
53. NNS- I like a big family.
54. NS – the biggest, the oldest
56. NNS – no, my sister is 30 and my brothers are 26 and 29.
57. NS – where do you live?
60. NNS – my sister lives in London

Figure 11;

37. NNS – cashel is in Tipperary
39. NS – what’s Tipperary?
42. NNS – TIPPERARY
44. NS – yes but what is it?
46. NNS – have you already been to cashel?
47. NNS – or do you know someone over there?
49. NS – no never
50. NS – no
51. NNS – alright
54. NNS – what classes do you have here?
55. NS – I have just been in and around Dublin, to the cliffs of Moher and along the coast.
218. NS – I was saying that Grenoble isn’t known for being interesting
219. NNS – yes
220. NS – But it’s cool...
222. NS – I’m not being critical.

64. NS – I think I “miss” her the most because we a very close.
65. NNS – I don’t understand “miss”
67. NS – Sorry I meant to say “miss”
69. NNS – oh!

249. NNS – I like sweets but also croissants...
252. NS – sweets?
253. NNS – yes
254. NS – but they’re not French
255. NNS – no, ‘bonbons’ is sweets no?....
261. NS- Food is really expensive here

224. NS – I’m just saying that you haven’t seen “the best” in France...
228. NNS – what is “the best” according to you?
229. NS- for university?
230. NNS- yes
231. NS- I don’t know for your subjects
232. NNS – oh but what’s the best in france 😊
233. NS- but I think the university is good over there.
234. NNS – cool
235. NS – to visit?
236. NNS – yes
237. NS- well the south, Paris, Brittany...
356 NS- you speak better than most of the Irish people I’ve met

246. NNS – Do you study at a university or at a “grande ecole”?
248. NS- a university
250 NNS- A university, ok ;)
251.NNS - oui
Figure 17;

144. NNS – It’s a nice place, there are a lot of tourists
177. NNS – there are a lot of colleges* DIT in Dublin.....
186. NNS – yes still, I live with my best friends, a lot of friends from Cavan study in Dublin and i have lots of friends living in Dublin.
192. NNS – yes we have to, there are no colleges in the countryside but in the cities......
194. NNS – and you, do you live with friends in Dublin?
195. NS – it’s the same in France.
196. NS – but there are more cities
197. NNS – yes, lots of cities, I have to go, see ya.

Figure 18;

163. NNS – I love the smell of the factory
169. NS – we say “l’odeur”
171. NNS – yes the smell
172. NNS – cool

Figure 19;

16. NNS – no a problem with my French
30. NNS – i would like to speak “Portuguese”
36. NS – do you study French or something else?
37. NS – “portugese” is “portuguais” in French
38. NNS – I study French* in school for 6 years but I don’t speak French and now I study French at TCD.

Figure 20;

302. NNS – and how do you “get on”?
303. NNS- ???
304. NNS – “get on???” ...
307. NS- “get on”( !)
336. NNS- did you go to “the party” last night?
337. NNS- “party?”
338. NNS – or “party?”
339. NNS – I forget
340. NS – what?
341. NS – night club?
342. NNS – no “night club” is “night club”?
343. NNS – “party” is party?
344. NS – yes
345. NS – “party”
346. NNS – “party”
347. NNS – “yes”
348.NS – I was at it
349.NNS – it’s that as well
350. NS – drank a little and then I went home
351. NNS – but is there another word for party...“party”? 
352. NNS- or something like that?
353. NNS – no?
354. NS – yes “boum”
355. NNS – yeah yeah
356. NNS – that’s it
355. NNS – lol :P

Figure 21;

NNS – that’s true this year I have to focus on Spanish, and i think my level of French will suffer
NS – I would like to learn Spanish because i like travelling and it’s spoken all over, in any case more
than German but for the moment i’m focusing on my English, one thing at a time.

Figure 22;

11. NS – I study “dentist”
13. NS – “dentist” – that’s interesting
21. NS – what are you afraid of?
22. NNS – the “dentist”
8. NNS – yes, European studies with two languages: French and “Russian”
19. NS- people say it’s a beautiful language. It’s difficult to be a judge of your own language
20. NNS- Russian?
21. NS – No French? I only know one word in Russian, it’s bistrot

Figure 23;

265. NNS – and are you happy here? (masc)
267. NS- Yes I am very happy (fem)

Figure 24;

Example One
37. NNS – cashel is “in” Tipperary
60. NS- yes i was “in” Galway briefly but i didn’t have the time, i have to go back there
73. NNS- and Erasmus “in”Dublin and all
99. NS – I went “to” Howth......
104. NNS – what do you think of the pubs “in” Dublin?
112. NNS- go to the little villages etc “in” Wicklow

Example Two
10. NNS – Are you doing ERASMUS “in” Trinity?
35. NNS- The second time I was “in” Cannes
48. Ns – if you don’t like the countryside, you could live “in” Paris no problem
51. NNS- yes, I would like to live “in” Paris.
56. NS – having studied “in” Paris for two years it came as a shock....yes I’m here since July.

Figure 24;

158. NNS – my friends in Ireland....but when I will go (sorry for my grammar) away from Ireland
after a year, “new friends” in France too
160. NS- did you make “new friends” in Trinity?
162. ...with new people and new friends that you can find.
C  ElAN Intructions
Appendix C - Instructions for ELAN

**Set up**

1. Install ELAN.
2. Input DVD with required Files.
3. Open ELAN

   In menu bar at the top:
   1. File – Open – Fr05.eaf (Select from folder containing .eaf files)
      The .avi file should automatically link, IF IT DOESN’T do this:
   2. Edit – Linked Files… – Add – Fr05.avi (Select from folder containing .avi files) – Apply – Close.

You should now have the corresponding .avi file in top left corner and the annotated tiers below.

**Navigation Tools**

Double click on the tier name of the last tier at the bottom of the annotations labelled “Negotiation Routines” indicated at A. This is used to navigate back and forth through the routines which are enumerated and have a brief note about their content (at C). In Appendix A – List of Figures, the files in which the examples illustrated in the report are noted.

The black arrows indicated at B are used to jump from each annotation to the next.

These arrows can be used to navigate through annotations on any tier. So, for example, by double clicking on the name of the tier labelled “NNS Negotiation Routines” you can navigate through all instances of negotiation on that tier...trigger...indicator etc..

If you place the cursor on the different options indicated at D their functionality appears i.e “move forward one second”... “move back one frame”....
Appendix C - Instructions for ELAN

**Specific Searches**

To search for particular instances of negotiation routines, i.e. recasts, clarification requests etc. the search function can be used (Ctrl+f) or “Search” menu bar at the top.

Select tier to search in at A. Select type of annotation sought at B and begin search by clicking play button at C. Results will appear in the box indicated at D. By double clicking on these lines you will navigate directly to that occurrence.