The Construal of Experience in HCI: Understanding Self-Reports

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Abstract

Design is driven by our understanding of users' experiences. This understanding rests primarily upon users' reports of their experiences, in the moment, after the fact, or ahead of time. In this paper we ask how the study of and design for experience might be better informed by attending more carefully to differences between these reports. Based on a broad and interdisciplinary literature review, we develop a conceptual framework of multiple selves, each representing a stage in the consolidation of experience accessed by self-report. We explore the use of this framework to support the interpretation of user experience, provide insight into users' evaluations of their own experiences, and emphasise the importance of design for experience as lived and reflected upon. We discuss the implications of this framing of experience for design, particularly in the case of systems to support self-knowledge, wellbeing, behaviour change, reflection, and decision making.

Keywords: Self Report, User Experience, Design, EMA, Experiencing Self, Remembering Self, Future Self, Behaviour Change, Wellbeing, Decision Making

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1. Introduction

As designers we wish to understand user experience, motivated by the philosophy that a better understanding of experience supports design. However, understanding the experience of use can be a challenging task, particularly as the products and systems we develop become more entwined within our lives. In this paper, we make the case that the study of and design for experience can be better informed if we attend more carefully to differences between reports of experience elicited in the moment, after the fact, and ahead of time.

Much of our understanding of user experience derives from self report. At a high-level, the process of user-centred design can be interpreted as follows; we conduct research to understand users' needs, values, and experiences in context, develop a set of requirements, use these insights to guide the creative process, implement a prototype or several, evaluate these with users, and iterate. Our interpretation of experience can therefore be loosely viewed as a cycle of three phases; research, analysis and synthesis.

1.1. Research: Reports of Experience

Design researchers employ a variety of methods to access users' impressions of their experiences with and without respect to technology. These include forms of a) observation, b) interviewing, c) directed activities such as storytelling, role playing and collaging, and d) directed self-reporting, including questionnaires, beeper studies, journalling and think-aloud protocols (Cooper et al., 2007).

Each of these methods, with the possible exception of observation, relies upon self-report. Our understanding of experience depends upon the conscious impressions provided to us by users.

Self report is therefore integral to design research, and yet, the design of self-report itself is not as straightforward a task as it may seem. Different forms of self-report can provide significantly skewed impressions of experience (Schwarz, 2012; Schuman and Presser, 1979). Striking differences are often found between reports of experience made in the moment (momentary reports) and after the fact (retrospective reports) in particular.

Much of this evidence derives from the cognitive psychology literature. It has been found, for example, that increasing the recall period from 1 day to 7 days leads to an increase in retrospective ratings of pain among rheumatology patients, despite no increase in momentary reports over time (Broderick et al., 2008). In another study, a fear of dying was said to occur in 70% of panic attacks when reported by retrospective questionnaire but in only 3% of attacks reported in diary form by the same participants. Faintness was reported in 89% of panic attacks retrospectively but in only 10% momentarily (Margraf et al., 1987). Low levels of correlation have also been found between reports of coping behaviours in the moment and after the fact (Stone et al., 1998), and between objective and subjective measures of physical activity (Santangelo et al., 2013; Ebner-Priemer and Trull, 2009b). Retrospective and momentary reports of extreme mood changes have been found to have "almost no relationship" (Solhan et al., 2009). Couples asked to evaluate their honeymoon recalled

the experience more negatively years later if experiencing relationship troubles (Holmberg and Holmes, 1994).

The questions we seek to explore in design are framed by the mode of report, and we employ multiple tenses; 'Will you enjoy the experience?' 'Are you enjoying the experience?' 'Did you enjoy the experience?' 'Would you enjoy the experience again?'. A retrospective framing is often favoured, for pragmatic reasons, and to gain insight into users' reasoning about experience. Although there has been a push within HCI for the evaluation of systems 'in the wild' (Kjeldskov and Graham, 2003; Consolvo et al., 2008; Rennick-Egglestone et al., 2016), the implications of different modes of self-report within HCI remain under-explored.

1.2. Analysis: Making Sense of Experience

The designer's task is then to make sense of these assembled reports of experience. Often, a number of organisational and interpretive methods are employed, including diagrams, personas, empathy maps, scenarios, storyboards, task analyses, mental models, affordance mapping, and use cases (Cooper et al., 2007). Given the retrospective nature of much design research, this is often a process of 'retrospective reversal' (Conway et al., 2016).

The more technologies mediate our experiences, the more difficult it becomes to extract meaningful insights with respect to their use. Understanding experience can require an understanding of both action and reflection. Within HCI, experience is at times reported from multiple temporal perspectives (Latulipe et al., 2011; Aharony et al., 2011; Van Gennip et al., 2015; Frommel et al., 2015). However, these reports are often used to assess different components of experience in isolation, and differences between reports of experience by the same users are rarely reported or examined. We will argue that it is not just in the content of self-reports that knowledge is to be found, but also in the comparison and combination of mechanisms of report.

1.3. Synthesis: Creating Experience

Design is oriented towards the conception of new experiences. The designer employs their interpretation of users' experiences, in the form of implicit mental models and theories (Staggers and Norcio, 1993), to guide creativity and appropriate decision decisions. Methods such as brainstorming, mood boards, prototyping, and word association can be employed in the creative process, as can behavioural theory (Consolvo et al., 2008; Hekler et al., 2013) and design guidelines (Consolvo et al., 2009) relevant to the context of application.

As we move, within HCI, towards design for complex psychological phenomena such as motivation, empathy, compassion, positive emotions, and wellbeing (Calvo and Peters, 2014), it is important that we understand not just experience as presented to us but how users evaluate their own experiences (Kahneman and Riis, 2005).

In recent years, HCI researchers have also developed new motivations for the interpretation of self-reports. Users of many technologies today are voluntarily engaged in the processes of self report, not for the purposes of research, but through mobile applications and wearable devices for the collection of health data (Morris et al., 2010; Hicks et al., 2010), to inspire behaviour change (Schueller et al., 2014), and to support social connections (Harper et al., 2012).

1.4. Modelling User Experience

User experience has been defined as a "person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service" [ISO 9241-210:2010]. When we talk about experience, we are therefore talking about perception and interpretation. HCI researchers have attempted to express the nature of these processes over time through models of experience.

Forlizzi & Battarbee provide a framework for the interpretation of interactive experience which distinguishes the notions of 'experience', 'an experience', and 'experience as story' (Forlizzi and Ford, 2000). The authors describe experiences as migrating from cognitive to sub-conscious over time, and distinguish between fluent, cognitive, and expressive user-product interactions (Forlizzi and Battarbee, 2004).

Karapanos et al. propose a model of user experience as a process of technological adoption, including phases of orientation, incorporation, and identification. The authors write that "while early experiences seemed to relate mostly to hedonic aspects of product use, prolonged experiences became increasingly more tied to aspects reflecting how the product becomes meaningful in one's life". The forces of increasing familiarity, functional dependency, and emotional attachment are considered to guide changes in the user experience over time (Karapanos et al., 2010). Silverstone & Haddon also plot the evolution of a user's evolving relationship with a product over time through the process of technological domestication (Silverstone and Haddon, 1996).

The User Experience Lifecycle Model, ContinUE, distinguishes between sequential phases in the lifecycle of a product's use, including experience before, during, and after use, and the possibility of repeated interaction (Pohlmeyer et al., 2009). Magni et al. present a model of hedonic and instrumental factors in users' intentions to explore a technology over time (Magni et al., 2010). Kujala et al. present a model of long-term UX created at a NordiCHI workshop organised to address the lack of "an understanding of time and the meaning of temporal aspects in UX", which references user expectations, momentary, and summarised experiences (Kujala et al., 2013). Huang & Stolterman propose a method of visually analysing changes to the functions, interfaces and use goals of interactive artefacts over time (Huang and Stolterman, 2012).

Models of user experience have portrayed technology use as comprised of a variety of phases including anticipation, interaction, and reflection. However, it is not always clear how such models can be used to enhance user research. HCI research has been described as the "construction of the possible and empirical investigation of the impossible" (Oulasvirta, 2009). We require models of experience to support both thick description and precise implications for design. To address this tension we need a way to relate theories of experience to design practice.

1.5. Self Report & Experience

Overbeeke & Wensveen write that "[r]eflection on action (of designers and users) is the source of knowledge" (Overbeeke and Wensveen, 2003). We extend previous HCI work by proposing the characterisation of experience in terms of multiple self-concepts relevant to the study and design of self-report. By focusing upon the methodology of self-report we attempt to establish a link between theories of experience and design practice. This framework is grounded in previous theoretical and empirical work but presented in a pragmatic form so as to function as a heuristic and sense making tool. This method supports design for experiencing and thinking users.

Following presentation of the methodology of review in Section 2, we characterise experiencing, remembering, and future-oriented self-concepts as points in the consolidation of experience, in Section 3. In Section 4, we then highlight momentary, retrospective, and prospective modes of reflection, drawing on distinct sources of knowledge, as processes in the construal of experience. In Section 5, we introduce the concept of inter-self dissonance to help explain differences between self-reports of the same experience, and discuss its implications for design. Many technologies today actively involve their users in processes of creation, interpretation, and narration; particular construals of experience realised through design. In Section 6, we describe how multiple self-concepts can support designers to gather reports of, make sense of, and create new, user experiences.

2. Methodology

The conceptual framework presented in this paper was informed by a broad and interdisciplinary literature review of the HCI and psychology literatures.

The initial focus of review was the design of technologies for Ecological Momentary Assessment (EMA) and Intervention (EMI). An exhaustive search, on the topic of self-report and design, additionally highlighted a) consistent significant differences between momentary and retrospective reports within psychology, b) the need for a systematic analysis of subjective experience and its mechanisms of report within HCI c) the gap between what is known about temporally-distinct forms of self-report and the ability to make pragmatic use of this knowledge, and

d) a small psychology literature relating mechanisms of self-report to a variety of self-conceptions.

The original corpus was gathered during the month of April 2015 by searching the databases, ACM Digital Library, PsycINFO and PsycARTICLES (combined search), JSTOR and Google Scholar, by keyword and title where possible, using the first level terms Ecological Momentary Assessment, Ambulatory Assessment, Experience Sampling, Ecological Momentary Intervention, Diary Methods, EMA, EMI, and ESM, and the second and third level terms Design and Mobile Devices.

The results of these searches were screened by abstract, and by full paper when necessary. Papers meeting the following inclusion criteria were selected for the final analysis; empirical investigations using an EMA self-report approach, user study or description of the implementation of EMAI systems, review or broad analysis of the design and present or future use of EMAI systems.

This sample (n=286) included a subset of papers (n=42) which referenced multiple self-conceptions. Snowballing (Shachak and Reis, 2009), as employed in the original review process, was continued in the development of this paper in early 2017, to obtain an additional sample (n=47) related to the use of multiple self-conceptions within HCI and psychology. This corpus combines work across both HCI and psychology comprising multiple self perspectives and their application to the design of digital technologies.

3. The Self-Consolidation of Experience

By definition, all experiences are perceived. Some are recollected, and others are not, some shape one's sense of self, and others do not. We refer to this complex and individual process as the consolidation of experience. HCI researchers recognise the limitations of human memory and cognition (Chalmers, 2003; Oviatt, 2006). However, the neurophysiology of memory, cognition, and emotion is complex, interlinked, and not fully understood (Conway and Loveday, 2015).

Given designers' familiarity with characterisation as a means of making sense of experience, through personas, storyboarding, and mental models, we propose the value of a model of experience characterised by multiple self-concepts.

The self-construct is "widely regarded to be multidimensional" (Rathbone et al., 2011), and multiple models have been proposed. Conway & Pleydell-Pearce's Self Memory System (SMS) models the relationship of autobiographical memory to the self, comprising the episodic memory system, the long-term self, and the working self (Conway et al., 2004). Other proposed divisions of the self include past, present, and future selves (Wilson, 2009), actual, ideal, and ought selves, nodes in an associative memory network, hierarchical or categorical structures whose elements are traits, values, and memories of specific behaviors, multidimensional meaning spaces, and a system of
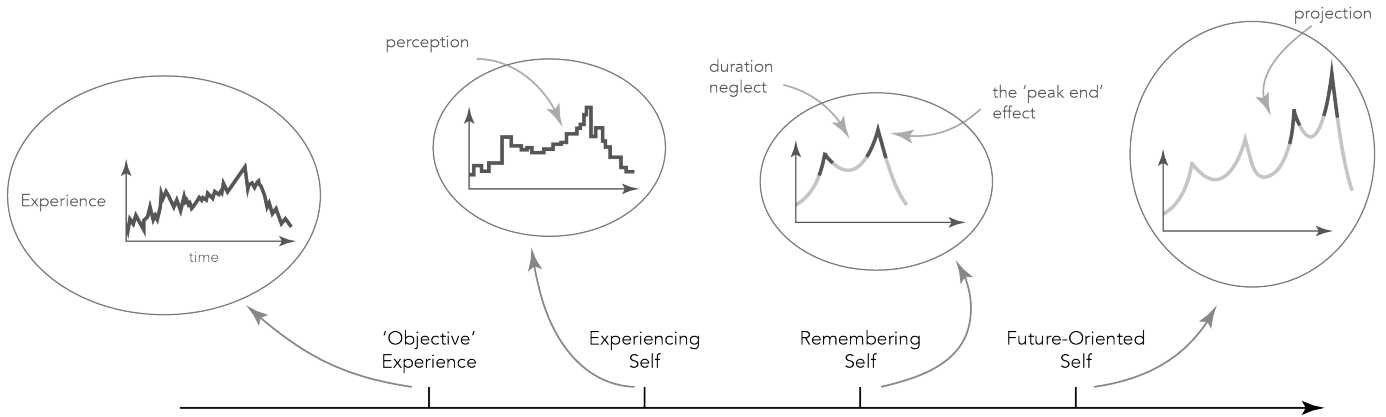
Figure 1: The Consolidation of Experience through Multiple Selves

self-schemas or generalizations about the self derived from past social experiences (Markus and Wurf, 1987). Self-conceptions have also been studied with respect to identity "an image of the self that one tries to convey to others" (Markus and Wurf, 1987), and as extended socially, "beginning with an individual atomized self and radiating outward into the world" (Belk, 2010). Previous HCI research has examined the construction and presentation of self, "a particularly salient feature of making sense of experience" (McCarthy and Wright, 2004), as in role playing games (Turkle, 1994), or through social networks (DiMicco and Millen, 2007).

Based on a broad and inter-disciplinary literature review, we have chosen three self-concepts, characterisations of the consolidation of experience, which we consider to support the study and design of self-report. We describe these as the experiencing, remembering, and future-oriented selves. As shown in Fig. 1 we view the consolidation of experience as a process comprising the perception of 'objective experience' by the experiencing self, its reconstruction by the remembering self, and finally its extrapolation in the shaping of a future-oriented self perspective.

Conceptions of multiple selves as active participants in experience have previously featured in cognitive psychology research, notably in the works of Kahneman & Riis (Kahneman and Riis, 2005) and Conner & Barrett (Conner and Barrett, 2012; Santangelo et al., 2013; Zirkel et al., 2015). These selves could also be interpreted as distinct components of the SMS model's 'working' self (Conway et al., 2004). In this instance we attempt to provide a grounding for these selves by unifying several threads of research and relating their construction to the processes of self report.

The self-consolidation of experience is a continuous process. However, by demarcating representations of the self we can build a framework through which to understand experience as it is lived, remembered, and envisioned. The selves within this framework are not purely distinguished by time or memory but are active 'experiencing' characters which play a role in the interpretation of experience.

3.0.1. The Experiencing Self

> "The experiencing self is, essentially, the 'front line' self that functions to help individuals maintain homeostasis and navigate physical and social environments in situ" (Conner and Barrett, 2012)

The ancient Greeks employed two words to describe the passage of time; 'chronos', which referred to the chronological passage of the hours, and 'kairos', which signified a brief, lived-in, opportune moment (Erickson, 2015). This latter notion captures an optimal form of the perpetual instant in which the 'experiencing self' exists.

In HCI, much of the analysis of time has been with respect to concepts such as cognitive absorption (Agarwal and Karahanna, 2000), flow theory (Pearce and Howard, 2004) and studies of time perception (Nordin et al., 2013). The focus has therefore often been upon short periods of interaction, with the notable exceptions of longitudinal experience sampling (Ebner-Priemer and Trull, 2009b) and previous models of interaction over time (Silverstone and Haddon, 1996; Pohlmeyer et al., 2009; Karapanos et al., 2009; Huang and Stolterman, 2012). The 'experiencing self' is continually present in sustained interaction. An unintuitive feature of this self is that this stage in the interpretation of experience is concealed from our own retrospection. Any memory involved in the experiencing self is fleeting and these brief periods of time thus simply vanish from our cognitive grasp. The self that "lives each of these moments barely has time to exist" (Kahneman and Riis, 2005).

Although the experiencing self might slip from our consciousness, this is not to say that its status does not hold significance for our conception of experience on the whole. As the first stage of interpretation in the perception of experience, the experiencing self's conscious distortion of 'objective experience' is limited. However, neither do reports of this self yield an exact impression. Experience, as lived and reported through the experiencing self, is altered by psychological processes including an individual's level of attention, mood, expressed social-desirability, and other

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traits of a contextually focused nature. An evidential basis for this self-characterisation is found in the fleeting nature of episodic memory (Conway et al., 2004) and pronounced differences between momentary and retrospective reports (Margraf et al., 1987; Holmberg and Holmes, 1994; Stone et al., 1998; Solhan et al., 2009; Ebner-Priemer and Trull, 2009b; Santangelo et al., 2013).

3.0.2. The Remembering Self

> "[T]he remembering self filters and consolidates our experiences so that we can learn, communicate, and make decisions about the future based on our past" (Conner and Barrett, 2012)

The remembering self, a step further along in the consolidation of experience, is more strongly "tinged with the identity of the person" (Beal and Weiss, 2003). We are all familiar with the experience of replaying events in our minds, reliving emotions, embellishing the memory of particular activities, sharing recollections, returning to a previous time, or trying to block one out; actively tending to the narrative of our lives. Indeed, many of our technologies are moving towards facilitating the curation of experience, the projection of self, and reflection upon past events. Whenever we pause to reflect on past experience, it is the reconstructed perspective of the remembering self which we adopt.

The perspective of the remembering self is guided by a significant number of cognitive processes, biases, and heuristics, not all of which are self-serving and many of which are unconscious in nature. Such phenomena include the effects of prior beliefs (Shiffman et al., 2008), the exaggerated influence of recent and salient events (the peak-end effect) (Robbins and Kubiak, 2014), the availability heuristic, the affective valence effect, the mood congruent memory effect, duration neglect (Ebner-Priemer and Trull, 2009a,b), cognitive structures, implicit theories and motivations (McFarland et al., 1989; Barrett and Barrett, 2001; Shiffman et al., 2008), the 'effort-after-meaning' effect (Stone et al., 1999), the 'telescoping' bias (Stone et al., 1999), social desirability effects, and cultural norms (Scollon et al., 2009). When subjects are asked to self report, the design of the query itself can introduce additional biases through anchoring and priming effects (Schwarz, 2012).

It has thus been claimed that the perspective of the remembering self is as much theory as experience driven (Schwarz, 2012). This research highlights the risks in adopting retrospective self reports of experience as an accurate reflection of objective events. As technologies mediate more of our lives, the perspective of the remembering self and its consolidation of experience is further filtered by objects of design.

There is evidence of correlation between these self-concepts and biological processes. Conner & Barrett show that the experiencing self is more closely tied to corporeal processes and to the salience network than the remembering self which is linked more closely to memory networks. These are "different functional selves with different neurobiology" (Conner and Barrett, 2012). Cognitive psychology researchers have gone as far as to describe a 'conflict of interest' between the selves - the experiencing self concerned with immediate experience, the remembering self with its memory alone (Kahneman, 2011).

3.0.3. The Future-Oriented Self

> "[T]he believing self is also a 'story teller' but at a higher level of abstraction that reflects the collection of identities and self concepts that help individuals maintain identity through time (2). The believing self also serves as mental scaffolding for interpreting incoming information, and for anticipating and forecasting the future, among other roles (2, 45)" (Conner and Barrett, 2012)

A third perspective, the future-oriented, or 'believing' self reveals an individual's envisaged and aspiration-tinged view of their future self, the result of "abstract, nebulous, sometimes unconscious motives" (Markus and Wurf, 1987). We interpret the future-oriented self as engaged in self-projection rather than a projection itself (Rathbone et al., 2011). It is therefore associated with motivation, choice, and individual values. Mary-Helen Immordino-Yang, writing in (Calvo and Peters, 2014), states that "morally and socially complex varieties of inspiration may involve distancing oneself from the current context in order to build connections to past experiences, personal values, and possible futures". Previous research has revealed overlaps between the process of remembering and imagining to the extent that "it has been suggested that the term 'memory system' be replaced with the term 'remembering-imagining system' in order to emphasise the constructive nature of remembering the past and imagining the future" (Rathbone et al., 2011; Conway et al., 2016)

This final self also reflects the role of narrative in our interpretation of experience and conception of self, "a persons internalized and evolving life story, integrating the reconstructed past and imagined future to provide life with some degree of unity and purpose" (McAdams and McLean, 2013). Stories are "not about time passing" but about "significant events and memorable moments" (Kahneman and Riis, 2005). Given the degree to which "people care deeply about the narrative of their life" (Kahneman and Riis, 2005), querying users about their future intentions can prove unreliable, though may shed light on the nature of continuous, repeated interaction, and the factors underlying engagement.

3.1. Experiencing, Remembering, and Envisioning

These self-concepts matter because in order to understand experience, and therefore to design effectively, we

require insight into experience as it is lived, reflected upon, and envisaged. Previous research has shown that outcomes we often wish to support through design, such as wellbeing, consist of components which are "at least partly independent of each other" with respect to their evaluation (Kahneman and Riis, 2005).

This framework of three selves provides structure to the interpretation of user experience. The optimal design of a self-report study can be considered in light of the contribution of each self-perspective. Furthermore, we can reason about design in terms of the distinct experience of each self.

4. The Construal of Experience

In the previous section we highlighted three selves, points in the consolidation of experience.

In this section we examine the composition of these selves in greater detail; the source of knowledge which each self comprises and the processes of construal of experience through reflection and particular mechanisms of report. We also diagrammatically relate these selves to the more commonly employed singular self-construct, its related theories and development (Fig. 2). By doing so, we align common HCI theories and concepts, typically associated with a singular self-perspective, to these self-concepts.

Support for this representation can be found in Markus & Wurf's dynamic self concept which describes "the self-concept of the moment" as "a continually active, shifting array of accessible self-knowledge" (Markus and Wurf, 1987), and the SMS model which describes memories as "transient constructions", "patterns of activation over knowledge structures", which "contain many details that are inferred, consciously and non-consciously, at the time of their construction" (Conway and Loveday, 2015). We can therefore distinguish between change to the self perspectives and to the underlying, constitutional self-concept, "change of a more enduring nature" (Markus and Wurf, 1987). Features of this framing may also be found in dual process theories of cognition such as the Heuristic-Systemic Model of Social Information Processing (HSM) (Todorov et al., 2002), and the Elaboration-Likelihood Model of Persuasion (ELM) (Petty and Cacioppo, 1986), as well as social cognitive theories (Dweck and Leggett, 1988).

Each of these self-concepts is informed by relatively stable or dynamic components of the more general self-construct. We present here several factors which commonly arise in HCI research and featured within this corpus. The focus of the experiencing self, for example, is influenced primarily by dynamic factors such as perceived task, physical, social and temporal context (Bradley and Dunlop, 2005), attentional resources (Oulasvirta et al., 2005), and affective states (Boehner et al., 2005). The remembering self is driven to a greater extent by integrated components of the self including standards, goals, attitudes (Desmet et al., 2001), and the constructed life narrative (Conway et al., 2004; McAdams and McLean, 2013), and the future-oriented self by factors such as implicit theories (Dweck and Leggett, 1988), psychological needs (Deci and Ryan, 2000), and personality (Ilies and Judge, 2002).

These three selves are engaged in reflection on experience.

4.1. Momentary Reflection

The research methodology of momentary assessment includes concurrent think-aloud protocols but refers primarily to ecological momentary assessment (EMA), the experience sampling method (ESM), and ambulatory assessment (AA) (Ebner-Priemer and Trull, 2009a). Momentary reports allow the researcher to recapture those elements of experience which are lost to the individual retrospectively and which "take place 'behind closed doors' (literally and figuratively)" (Zirkel et al., 2015). The fact that the experiencing self slips quickly from consciousness also suggests that there are insights to be gained through the 'recapture' of this information.

The motivation for momentary reporting is closely tied to the circumvention of the motivational processes which affect retrospective self-reports (Christensen et al., 2003). The type of analysis facilitated by EMA data, both within and across participants, has been termed idiothetic, and ipsative-normative "where 'ipsative' refers to deviations around the individual mean and 'normative' refers to deviations around the group mean" (Conner et al., 2009). However, biases are also associated with momentary reports, including reactivity, habituation to the act of reporting, and psychological defence strategies such as social desirability (Barta et al., 2012). To gauge the potential effects of any such biases requires careful consideration of the type of knowledge it is desired to capture momentarily (Scollon et al., 2009).

In addition to providing a picture of experience closest to the 'objective' form, the primary methodological advantages of EMA include improved ecological validity and the facilitation of longitudinal analyses. Combined, these allow for the study of psychological phenomena and human experience as dynamic in nature and influenced by context - a significant step towards the study of experience as lived (Shiffman et al., 2008). Previous research suggests that this perspective is particularly important to the study of mental health. One study (n=108) found that the variability, rather than intensity, of **depressive affect** predicted suicidal ideation and suicide attempts among college students (Witte et al., 2005). Another (n=36) found that EMA measures of affect predicted non-suicidal self-injurious behaviour (Armey et al., 2011). The widespread adoption of mobile devices has meant that real-time reports of experience can now be obtained much more efficiently and frequently. While this means of conducting research has yet to reach its potential (Miller, 2012), it presents new opportunities to capture life as lived in the moment.
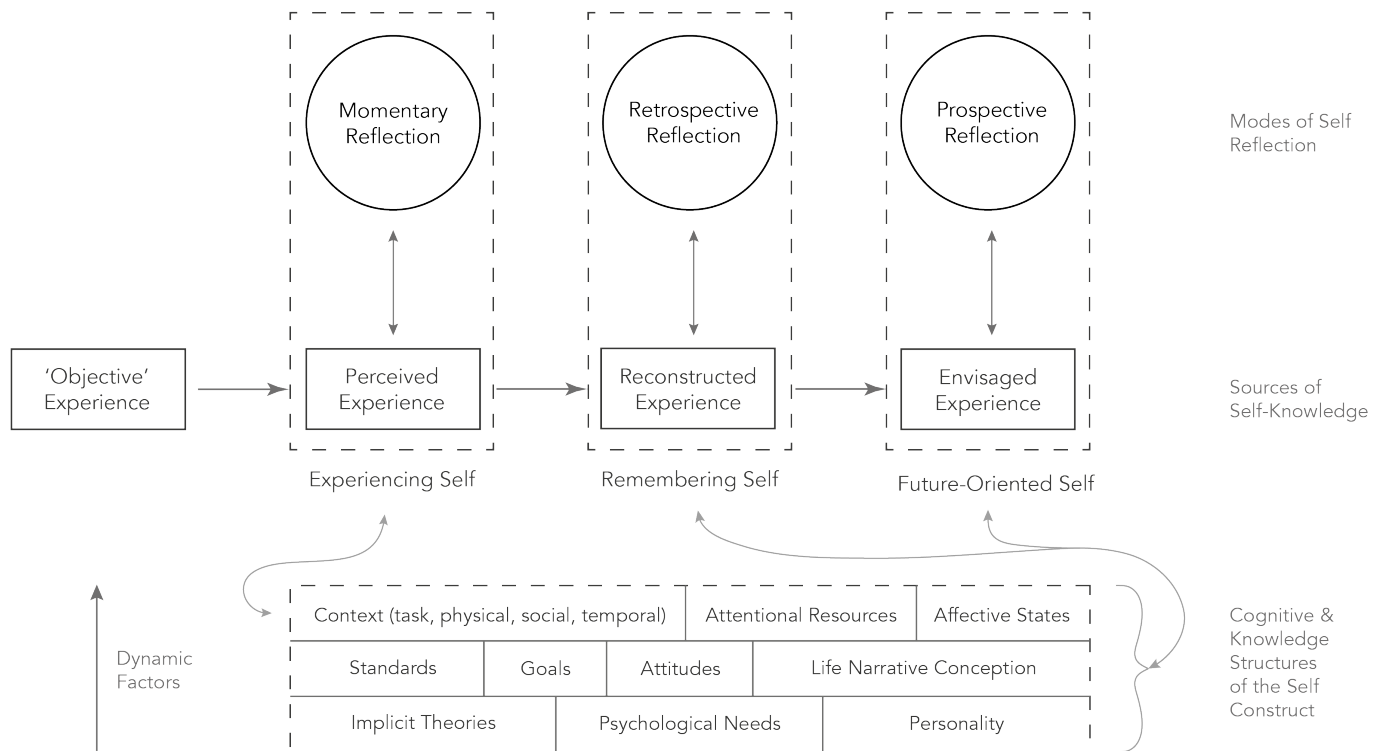
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Figure 2: A Diagrammatic Representation of Experiential Construal

Characteristics of momentary reflection, as interpreted here, include;

- momentary reflection is 'present oriented'

- momentary reflection can be considered to consist of minimal rumination (Petty and Cacioppo, 1986; Todorov et al., 2002)

- the degree of focused momentary attention apportioned to an event can drive the consolidation of that memory (Conway and Loveday, 2015)

- momentary reflection accesses 'experiencing self' truths

- reports of experience obtained through momentary reflection are less influenced by cognitive heuristics and biases (though still affected to some extent by a number of factors such as priming effects, attention, affect, environmental stimuli, and the social context) (Shiffman et al., 2008)

- momentary reflection provides a subjective view of experience which most accurately reflects the original context

- momentary reflection is more sensitive to the linear progression of time (momentary data therefore facilitates the longitudinal analysis of dynamic experience) (Schwarz, 2012)

- momentary reflection typically reflects a spontaneous reaction to stimuli or affordance rather than a meditated response

4.2. Retrospective Reflection

Retrospective means of assessment are popular within HCI, and most other fields of study of human behaviour, given their relative ease of application (Brinkman, 2009). They are easy to apply (although valid questionnaires require much effort to develop) and facilitate the comparison of different experiences within and between individuals. General methodological weaknesses can apply to these approaches, such as the fact that closed-ended questionnaires can tightly constrain responses (Schuman and Presser, 1979). However, we focus here upon the biases associated with the recall of experience. It is the counter-intuitive nature of these phenomena which renders them particularly worthy of study.

As Kahneman & Riis state "It is a common assumption of everyday conversation that people can provide accurate answers to questions about their feelings, both past (e.g. 'How was your vacation?') and current (e.g. 'Does this hurt?')" (Kahneman and Riis, 2005). However, numerous studies have demonstrated that the 'remembering self' frequently violates conventional logic (Margraf et al., 1987; Holmberg and Holmes, 1994; Stone et al., 1998; Solhan et al., 2009; Ebner-Priemer and Trull, 2009b; Santangelo et al., 2013).

Given the popularity of retrospective reports in research much of our knowledge of human experience rests on an assumed accuracy of recollection. Picture the proportion of design research in which users are requested to recall their experience of a particular website, device, sys-

tem, or interaction. We do not imply that such reports are inconsequential, but the consequences of this choice of perspective are worth considering. Often, it is not how well users remember their past experience which is of relevance to design but why certain details are reconstructed, and not others (Bluck et al., 2005). It is important to note that the remembering self's conception of an event is not static. It evolves over time, particularly if frequently revisited, and thus even reports of the same experience may differ over time due solely to the nature of memory and the processes of reconstruction involved in reflection.

Characteristics of retrospective reflection, as interpreted here, include;

- retrospective reflection is 'past oriented'

- retrospective reflection can be viewed as requiring a greater degree of purposeful rumination (Petty and Cacioppo, 1986; Todorov et al., 2002)

- retrospective reflection accesses 'remembering self' truths

- retrospective reflection involves reconstruction rather than recall (Stone and Shiffman, 2002) and is impacted by a significant number of cognitive processes, heuristics and biases, many unconscious (Stone et al., 1999)

- retrospective reflection is characterised by temporal distance from the experience which is the target of reflection. Although retrospective reflection may vary by 'temporal granularity' it can be engaged at any point or frequency post-experience

- retrospective reflection does not produce an accurate portrayal of the temporal flow of experience (Schwarz, 2012)

- retrospective reflection is focused upon the creation of narratives and allocates greater significance to prominent emotional or social events (Kahneman et al., 1993)

- retrospective reflection draws upon an extended store of knowledge and is therefore often both more 'global' and 'cumulative' in nature. It inspires comparative thinking, and can lead to false attributions of causality (Kahneman, 2011)

4.3. Prospective Reflection

The results of prospective assessments must be interpreted with care given the consolidated nature of the future-oriented self's view of experience. Temporal distance changes the way people mentally represent experience, and influences responses to future events. Events further into the future are more likely to be represented by "a few abstract features that convey the perceived essence of the events (high-level construals) rather than in terms of more concrete and incidental details of the events (low-level construals)" (Trope and Liberman, 2003). Near future preferences are more likely to be guided by affective goals and feasibility considerations, and distant-future preferences by cognitive goals and desirability considerations (ibid).

Although the potential fallibility of prospective reports is more easily grasped, its scale can still prove surprising. In one prominent experiment, 80% of subjects were found to choose to repeat (requiring prospective reflection) a longer period of immersion of one hand in painfully cold water, should the water's temperature by reduced slightly for the additional 30 seconds, "apparently preferring more pain over less" (Kahneman et al., 1993). This experiment demonstrates duration neglect and the peak-end effect, biases also associated with the remembering self. Such seemingly contradictory choices are found elsewhere. The Service Recovery Paradox (SRP) describes the phenomenon of increased customer satisfaction with a service following recovery from failure than prior to the failure (De Matos et al., 2007). Recent human-computer interaction studies have found peak-end effects with respect to screen-based interaction (Cockburn et al., 2015) and computer gaming (Gutwin et al., 2016).

The fact that a user's intention to repeat an interaction is strongly influenced by the peak or end of that experience, and less so by its duration, presents consequences for the analysis of interaction, as well as for designers' focus. This is furthermore the case given that the tight circle of human computer interaction often demands rapid decision making, requires frequent repetition, and relies upon prolonged user engagement. Characteristics of prospective reflection, as interpreted here, include;

- prospective reflection is 'future oriented'

- prospective reflection can be viewed as requiring greatest cognitive effort

- prospective reflection accesses 'future-oriented self' truths

- prospective reflection is furthest removed from 'objective experience'

- if prospective reflection is focused towards a particular future experience, it may also be termed 'anticipatory reflection'

4.4. Multiple Consciousness

These modes of reflection are not necessarily, and perhaps rarely, mutually exclusive but combined in a state of 'multiple consciousness' comprising participation and reflection.

> "We are involved in the experience, but even as we are involved we are already witnesses with one eye to the past and another to the future. In a sense, we live an experience in the light of how we are likely to recount it to others" (McCarthy and Wright, 2004)

These distinct selves play different roles within each individual and are most accurately viewed as dynamic entities - "as active, forceful, and capable of change" (Markus and Wurf, 1987). Reflection is employed in everyday life

but can also be purposefully initiated, as is often the case in the study of human behaviour, or encouraged by design.

States of multiple consciousness are only likely to have been heightened by our use of technology to share experience, as exemplified by practices from text-messaging (Grinter et al., 2006) to status sharing on social media (Cui and Wang, 2012), to the selfie phenomenon (Souza et al., 2015). The availability of such technologies grants us a greater capacity than ever before to record our experiences, to control the appearance of our life's narrative, and to present a desired self-image. Ubiquitous access to digital media, however, means that these presentations of our lives reach the largest audiences and make us more aware of the image we present.

Designers should be aware of the impact technologies have in our construal of the experiences we participate in and present to others. Many factors may steer us towards accessing one source of self-knowledge over another, from the wording of status requests to the perceived need for socially desirable reporting. A framework through which to rationalise such phenomena supports a design practice more sensitive to human behaviour.

4.5. Perils of Reflection

The act of reflection itself affects how we think about and what we think of experience. Not all forms of reflection are positive in nature. Prompting users to reflect upon their thoughts, emotions, and behaviours, whether for the purposes of research or through design, can also have negative effects (Siewert et al., 2011; Moberly and Watkins, 2008). This concern has been examined with respect to adaptive and maladaptive self-focus in depression and it has been proposed that there exist differences between experiential (mindful) self-awareness and analytical rumination (Watkins and Teasdale, 2004).

4.6. Synopsis

The self-concept engaged in experience, a source of knowledge and mode of reflection, is influenced by both technology use in our daily lives and by the design of self-report. These characterisations of self can support a richer understanding of the relationship between experience as assessed, and as lived and reflected upon.

5. Conflicting Self-Reports

We have seen that self-reports of the same experience do not always match. These disparities are often seen as a source of error but are also an opportunity to learn more about users. The characterisation of multiple selves provides a framework for interpretation. To facilitate this analysis, we introduce the concept of inter-self dissonance.

5.1. Ground Truth v. Self Truths

Instead of viewing these multiple perspectives as erroneous representations of experience, we can view these three 'selves' as yielding different forms of 'self-truth'. Fig. 3 outlines the possible dissonance relationships, incongruities, between each of the selves formed through the processes of experiential construal.

This notion of multiple truths has implications for the selection and comparison of mechanisms of report, as well as for the lived interpretation of experience. Importantly, these discrepancies may not be perceptible to any or all of the selves. In particular, an individual may not be aware of dissonance which comprises the experiencing self, given that access to this perspective is lost post-experience.

5.2. Self Knowledge [d_{OE}, d_{ER}, d_{OR}]

There is a growing focus within human-computer interaction on technologies whose primary purpose is self-report, not for nomothetic user research but for individual self-knowledge, behaviour change and well-being. Given the evidence of stark differences between temporally-distinct forms of report, the question arises, what would be the effect of revealing such discrepancies to individuals? Would such knowledge prove insightful or persuasive?

In the case of one study cited at the start of this paper, remarkable variations were found between momentary and retrospective reports of panic attacks (Margraf et al., 1987). One could hypothesise that highlighting such discrepancies to users of technologies for well-being and behaviour tracking could alone have a therapeutic affect, leading to a healthier overall self conception. In fact, De Beurs et al. examined panic attacks in 32 patients over a 12 week period (De Beurs et al., 1992). Before treatment, retrospective questionnaires overrated panic attacks significantly compared to continuous monitoring. After treatment, both report methods 'matched perfectly'. One interview with a user of a momentary reporting system would appear to lend support to this use of data. At first he expressed disappointment with the system, hoping it would have "told me how I was feeling, because that's one of the things I struggle with". Later however, "he expressed a comfortable curiosity in his mood patterns, and 'more confidence in my feelings'" (Morris et al., 2010). Studies suggest that those who "exhibit discrepancies between implicit and explicit measures of their self-concepts or motives" may be "especially low in emotional well-being and especially high in physiological reactivity, anxiety, self-doubt, defensiveness, and narcissism" (Wilson, 2009).

Rains also discusses the potential of *insightful self disclosure* (Rains and Keating, 2011), Hormuth of *chronic self awareness* (Hormuth, 1986). In one study, increased dizziness was reported momentarily by 35 patients but retrospectively to their general practitioner by only 7 (Barge-Schaapveld and Nicolson, 2002). In another unpublished study by Kubiak et al. cited in (Robbins and Kubiak, 2014), an electronic diary was employed to improve the
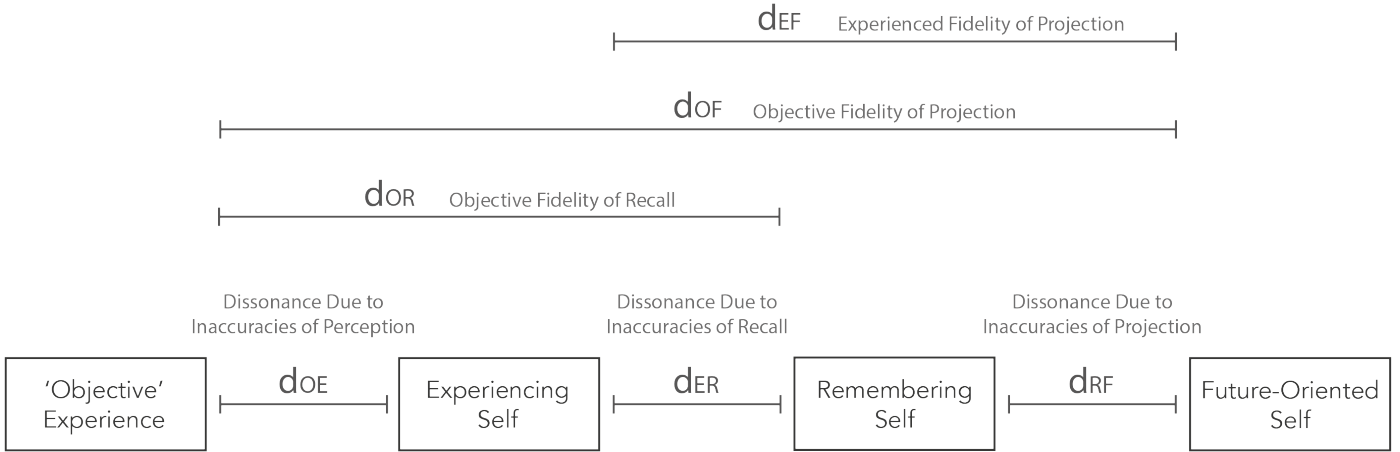
Figure 3: Inter-Self Dissonance

recognition of hypoglycemia in people with type 1 diabetes mellitus. Upon completing a choice reaction task when notified, participants were "prompted to estimate their performance and received immediate feedback on their actual performance. The underlying rationale was to help the patient notice subtle decrements in cognitive performance, which are common early signs of falling blood glucose levels".

Such examples provide evidence of the value of the knowledge to be gained from conflicting reports, even for the individual doing the reporting. Differences between self-reports elicited in the moment, after the fact, and ahead of time, may prove relevant to both the evaluation and motivation of change. However, such change must itself be assessed with care, and ideally momentarily. As Schwarz writes, "asking patients whether they feel better now than before their treatment is the most efficient way to 'improve' the success rate of medical interventions, which may explain the recent popularity of 'patient reported outcomes'" (Schwarz, 2012).

As users, we may not always be able to accurately recount our experience but there is an opportunity to learn from what we do recount, particularly when such accounts can be compared to our experience in the moment and our attitude towards repeating the experience.

5.3. Future Choices [d_{RF}, d_{EF}, d_{OF}]

The negative implication of inter-self dissonance, however, is poor future decision making. As Schwarz points out, one of the problems of the reconstructive nature of memory is that it impairs learning from daily experience (Schwarz, 2012). This applies to individuals but also to research and many forms of professional practice, including clinical psychology (Ebner-Priemer and Trull, 2009a), which rely on such data. If the remembering self holds a skewed picture of past experience then, although "biased estimates of the past can be good predictors of future choice" (Conner and Barrett, 2012), this may not lead to good future choices. This impaired learning means that

while the remembering or future-oriented self may not possess an accurate picture of experience, it is this picture which can best predict an individual's future actions.

> "description and prediction are different goals and their optimization requires different strategies" (Schwarz, 2012)

Personalised software and agents which intend to make predictions about future user needs and desires would do well to base such decision-making processes upon the most appropriate source(s) of self knowledge. In Wirtz et al's study of vacations, recalled, not experienced, enjoyment, predicted individuals' desire to repeat the experience (Wirtz et al., 2003). When the goal is to analyse behaviour change or future decision making, self truths can prove more important than ground truths (Hicks et al., 2010).

The term miswanting has been employed to describe the emergence of bad choices from affective forecasting (Gilbert and Wilson, 2000). A primary source of miswanting is the focusing illusion, succinctly expressed in the statement that "[n]othing in life is as important as you think it is when you are thinking about it" (Kahneman, 2011). When a user is asked how much they enjoyed using a device or application, we do not receive the answer to that question but to a subtly yet notably different one, how much that experience was enjoyed when it is reflected upon.

It is possible for any technology to provide an experience in the moment which is interpreted very differently at a later time. Momentary experiences, even positive ones, may not always be conducive to the needs and goals of other selves. Of course such rationalisation is highly personal and no one technology, as experiences in themselves, fits easily within a single category. However, considering multiple self-concepts can allow us to reach a fuller understanding of the impact of design.

Given that it is the remembering self which most strongly guides future behaviour, some have questioned

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the advantage of momentary reports, arguing, for example, that "it may not matter how a product was experienced in a given situation, but what individuals remember from this experience" (Karapanos et al., 2010). However, studies have shown that our evaluation of experience depends upon how we both live and reflect upon it (Kahneman and Riis, 2005). Much of design is driven by our understanding of users' choices; why we chose to use a given technology, why we continued to do so, and what motivates our return. These aims benefit from an understanding of the weight of different forms of self report in guiding choice.

5.4. The Drive to Reduce Dissonance

Anticipation, experience, and recollection all play a role in the evaluation of one's life-narrative.

Mitchell et al. posit three relationships between anticipation, experience, and recollection which can be located within a framework of inter-self dissonance (Mitchell et al., 1997). These are 'rosy prospection', a tendency to view future events more favourably than they will be experienced, 'rosy retrospection', a tendency to remember past events more favourably than experienced, and a consistency effect, the tendency to align the memory of an event with prior expectations (Mitchell et al., 1997). Experiments have shown that these phenomena are "associated with an increase in the number of negative thoughts during the event which seem to be caused by distractions, disappointment, and a less positive view of the self" (Mitchell et al., 1997).

We continuously reinterpret our experiences, which, compared to material possessions, "make people happier because they are more open to positive reinterpretations, are a more meaningful part of one's identity, and contribute more to successful social relationships" (Van Boven and Gilovich, 2003). As van Boven & Gilovich state, we enjoy the anticipation of experiences and further 'consume' their recollection.

The concept of inter-self dissonance supports the design of research and systems based on an understanding of not just what but how we think about experience.

6. Multiple Selves in Design

In this paper we have considered the use of multiple selves to characterise the construal of experience. With respect to the process of design, these selves can be employed to structure our understanding of experience.

This is a form of 'theory for design' (Zimmerman et al., 2010), and as such, is required to inhabit a rocky middle ground between thick description and precise implications. While grounded in an understanding of the interpretation of experience, this framework is sufficiently simple to function as a practical heuristic and sensemaking tool.

However, it is important not to overstate its determinacy. Understanding the link between the features of design and the experiences resulting from interaction is a

complex task. Users' responses are 'in most cases - not elicited by the product as such, but by meanings derived from the product" (Desmet et al., 2001). Our orientation is not towards the prescription of an overarching cognitive model of self but the practical and discursive value of an epistemological perspective of multiple self-concepts.

6.1. Understanding Experience

HCI researchers have made the case for a richer understanding of users' experiences (Elsden et al., 2016), greater "cross-pollination of ideas and methods between disciplines" and "the development of better theories" (Hekler et al., 2013).

These needs are driven by an evolution in the subject matter of design towards experiential and ambitious goals such as design for positive experiences, wellbeing, and the support of social relationships (Calvo and Peters, 2014). These efforts rest upon a belief in the capacity of technologies, and thereby their designers, to influence our lives in an intentional and meaningful fashion.

With respect to psychology it has been said that "[m]uch of what we know ... is based on what people tell us" (Barrett and Barrett, 2001). This is also the case within HCI, and yet reviews have described "a clear bias towards building systems and evaluating them only in laboratory settings, if at all" (Kjeldskov and Graham, 2003; Oulasvirta, 2009). The framework we have described underlines the importance of multiple temporal perspectives. These perspectives do not differ by temporality alone but by emotion, cognition, and reflection. There is value in understanding these differences as divergent sources of knowledge rather than as methodological biases alone.

Studies have shown that our evaluation of wellbeing depends upon how it is both lived and reflected upon, that "positive emotions belong to experienced utility; meaning and life satisfaction [...] to evaluation". Kahneman & Riis write that "[n]evertheless, the dominant practice in wellbeing research effectively ignores the issue, and continues to treat the determinants and consequences of happiness as if it were a unitary concept" (Kahneman and Riis, 2005). To avoid this same accusation, we argue that designers and researchers alike should strive to understand the features of experience we hope to shape as construed by multiple self perspectives.

When users think about a system, is it actual or recollected use which drives their appraisal? To create meaningful experiences for users it has been said that we need to "create a context for experience, rather than merely a product" (Overbeeke and Wensveen, 2003). Technologies which prove engaging and attract repeated, voluntary, and frequent use are likely to be those most able to support a wide range of subjective experience; to enable flow, "positive affect and richness of the felt experience" (Sas et al., 2015), to fit with users' social, hedonic and eudaimonic goals and to advance self-determination and control over one's life narrative (McAdams and McLean, 2013).

The framework depicts experience not as a single entity captured through self-report, or tidily presented retrospectively, but as lived, remembered, and envisaged

6.2. The Design of Self Report

A primary motivation for the elicitation of self reports is to better understand users' experiences and interactions (Latulipe et al., 2011; Aharony et al., 2011; Van Gennip et al., 2015; Frommel et al., 2015). It has been said that "[r]ather than try to capture everything, system design should focus on the psychological basis of human memory" (Sellen and Whittaker, 2010).

A heuristic of multiple selves can provide a rationale for the design of self-report. This framework suggests that a) different mechanisms of self-report tap divergent sources of knowledge, b) no one form of self-report provides a definitive representation of 'experience', and c) any single form of assessment or reflection does not alone reflect the state of multiple consciousness which mediates our experiences.

By understanding the selves as sources of self-truth with respect to momentary, retrospective and prospective reports, we can begin to derive understanding not just from the content of self-reports but from differences between them. Although retrospective and prospective reports may best predict future behaviour, momentary reports better reflect chronological and ecological use and behaviour. All three forms of assessment reflect consequences of design. Where at all possible, adopt at least two forms of report (Bolger et al., 2003), and if applying a single form of assessment acknowledge the perspective it provides.

6.3. Self Reporting Technologies

Clearly, reporting upon experience no longer falls within the remit of research alone. The subject matter of many new technologies is itself experience, its reflection, and recollection, over the long term, and through repeated interaction. Users are now involved in the active creation of self-focused narratives and technology is moving towards helping users make sense of their own experiences, engaging us in self-exploration.

These systems include social networks such as Facebook, Twitter, LinkedIn, and Instagram, YouTube vlogs, group messaging services such as WhatsApp and Viber, numerous behaviour tracking apps, websites for product, travel and accomodation reviews, online communities and forums, and quantified self technologies. In one study, usage of Facebook and Mail apps decreased by more than half when users were asked to report their sessions (Möller et al., 2013), demonstrating the influence of reflection on our use of these technologies.

Many behaviour change technologies focus on the elicitation of self reports to generate knowledge over time (Hekler et al., 2013; Hollis et al., 2015). Key challenges for these systems include the engagement of users and the extraction of actionable insights.

A possible, and common, criticism of mood or sleep tracking applications, for example, is that although it is becoming easier to track these concepts, the insights provided by this practice do not often extend beyond advice to close the blinds, avoid drinking coffee or using electronic devices before bed, and to maintain a sleep schedule. These reporting practices often focus on actual behaviour or momentary experience alone. The experiencing, remembering and future-oriented selves are all potential sources of insight however. Highlighting to a user that their retrospective reports of mood regularly do not match their momentary experience before bed may act to inspire change at the time of those momentary states. Reducing dissonance between the selves can therefore provide an anchor for behaviour change, and there may even be value in directly conveying representations of these selves to the user.

While the popularity of social networks and self-tracking technologies has highlighted many of the advantages and disadvantages of reporting on experience, it has also introduced the topic to the public domain, establishing a joint motivation for users, designers, and researchers to consider the report of experience.

6.4. Design for Reflection

When we consider the focus of HCI research, we can see that much of this practice is as centred on how people think about experiences as the act of interaction itself. Many among us are concerned with the design of technologies to support reflection (Hallnäs and Redström, 2001; Peesapati et al., 2010; Isaacs et al., 2013; Hollis et al., 2015), learning (Connolly et al., 2012), behaviour change (Hekler et al., 2013; Siegel and Beck, 2014; Hollis et al., 2015), wellbeing (Thieme et al., 2015), the presentation of identity to others (DiMicco and Millen, 2007; Dong et al., 2014), and the recording of experience (Sellen and Whittaker, 2010). These technologies do not so much instruct users as engage them in conversation, posing questions as much as answering them, and involving the user as an active participant in the creation of experience.

We have begun to recognise the "need for users to be able to reflect on their experience" (Rennick-Egglestone et al., 2016). However, reflection on past experience is not just a behaviour but a skill. This important distinction is highlighted in the design of MAHI, an application to support diabetes patients acquire reflective thinking skills through interaction with diabetes educators (Mamykina et al., 2008). The designers used breakdowns in understanding, characterised by a "a fleeting sense of meaning" as a "trigger for reflection" (Mamykina et al., 2008). This interpretation shifts the focus of design from 'activating' reflection to designing to supporting its development.

Another emerging thread of HCI research is design for memory and remembering (Norman, 2009; Van Gennip et al., 2015). This work is motivated by the importance of memory's directive, self-representative, and social functions (Bluck et al., 2005; van den Hoven, 2014). Van Den

Hoven discusses two case studies of design for memory; 'Cueb' "two interactive photo browse-and-display devices containing personal digital photo collections" for use by parents and teenagers, and 4Photos, an interactive device which displays digital photos from the facebook accounts of guests, to facilitate dinner talk (van den Hoven, 2014). As digital technologies grow in their ubiquity, it seems that practices of remembering are more and more likely to be externally rather than internally cued (van den Hoven, 2014). Design for memory and reflection presents new and interesting design challenges, particularly as these are not always "activities people set out to do" (Van Gennip et al., 2015).

The emerging vocabulary of 'technology-mediated reflection' (Isaacs et al., 2013) and 'remembering experiences' (van den Hoven, 2014) suggests the existence of a design practice already focused around modes of reflection.

Existing design methods, such as personas and scenarios, could be used in conjunction with a framing of multiple selves, the purpose of these methods being to reveal representative characters. This approach may demarcate the important features of experience at each point in its consolidation. Three types of goals are considered important for personas; experience goals, which describe how a user "wants to feel when using a product"; end goals, which describe what a user "could get out of using a well-designed product or service"; and life goals, which describe what the product means to the user (Goodwin, 2001).

These selves provide personas through which to design for multiple modes of reflection and sources of knowledge.

6.5. Evoking the Selves in Design

One way of looking at design in light of a heuristic of multiple selves is to consider 'design to evoke a specific self'. When we talk about experience design, often what we really talk about in a pragmatic sense is the design of 'levers' (Forlizzi and Ford, 2000), interaction with which is designed to contribute towards desired experiences.

We can recognize design for a particular self in previously published HCI design work, such as a web-based application for emotion-reporting designed to encourage users to "associate a bad habit with long-term emotional consequences, rather than the generally positive association of immediate relief" (Hollis et al., 2015) and an application which attempts to "sub-consciously or semi-consciously notify the gamer of how long they have been sedentary" by dimming the screen (Garg et al., 2014). We tend to 'frame' our use of technologies, even before interaction, as 'mindless or mindful' in nature (see Jackson (1998) as cited in (McCarthy and Wright, 2004)). The HCI community is already building an understanding of design to evoke particular selves without necessarily a means to categorise such work.

Harper et al. have studied the 'temporal experiencing' of Facebook and propose that its features lead "people to feel as if they are always acting 'in the now'" and their history "to disappear from view" (Harper et al., 2012). They describe this as a 'fixing' of the self. At the same time they write that "when people post a status update on Facebook, or, by the same token, when they read and comment on such a comment produced by others, they are not simply living in the durée but organising themselves, defining themselves, and the experience of themselves vis-à-vis their relations with others" (Harper et al., 2012).

One factor in the evocation of a particular self is time perception, given its relevance to the selection and pursuit of social goals (Carstensen et al., 1999). Many technologies today play a role in influencing users' perception of time, through instant access to large swathes of information or frequencies of social updates for example (Schüll, 2012). Fig. 2 highlights a number of HCI concepts which could be considered to influence an evocation of self.

A momentary storyboard might suggest how to manage flow, distraction, attention, and peak experience, a retrospective storyboard, memory cues, goals, and opportunities for reflection, and a future storyboard, motivations for repeated interaction and changes in one's self-conception or personal theories. Such an approach stresses the importance of how we both live and think about experience.

7. Conclusion

In this paper, we have presented an interpretation of experience as characterised by multiple self-concepts. The experiencing, remembering, and future-oriented selves tie this framing of experience to design practice through the methodology of self-report. We have argued that a sensitivity to multiple self-perspectives provides a framework for design and evaluation, particularly with respect to systems for behaviour change, wellbeing, and the report, interpretation, and mediation of experience. This approach supports design for experience as both lived and reflected upon.

8. Acknowledgements

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