Embodiment and Psychological Distance

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ABSTRACT
As the use of mobile technology becomes more prevalent, it becomes relevant to understand how the state of mobility itself affects people's judgments and understandings as part of their interaction with mobile devices. This project brings together theoretical insights from theories of psychological distance and embodiment to the use of digital technologies in everyday life. Participants were primed for home, distant or transit situations using directed imagination tasks and then answered a battery of tests designed to explore time perception. Being in transit appeared to disrupt the way that participants rescheduled appointments. Different primes also affected how far away people conceived past and future to be. We discuss these findings in terms of the perceived movement of time, agency and psychological distance.

Keywords
Cognition, Embodiment, Psychological Distance, Human Factors in Mobile Computing, Scheduling

1. INTRODUCTION
While notions of 'context aware' computing are well established, ironically less attention has arguably been given to the impact of the mobile context on human cognition. Given that mobile technology allows for use in locations other than home and office as well as when the user is in motion, the study of human-computer interaction would benefit from a better understanding of how embodiment and psychological distance can impact on human perception and by extension, how it can alter the human experience with technology. Psychological research has found that a person's location and physical state (or priming to such) may impact on each other, on mental representations of abstract concepts and on performance in subsequent, unrelated tasks [1]. Two bodies of theory speak to these specific issues: embodiment and psychological distance.

1.1 Embodiment and construal level
People tend to find reasoning about time difficult because of its abstract nature and thus in general tend to think about time as if it were space in order to use better-developed cognitive facilities [2]. As time is generally considered a linear entity through which one moves, it is easily analogised as movement on a path. Given that spatial language is used to represent temporal concepts, it can also be asked if spatial location and state themselves (i.e. static or in motion) impact upon how one might interpret temporally-ambiguous information. Boroditsky and Ramscar [3] report a series of experiments suggesting that people who are in motion, or who are thinking about being in motion are more inclined to also see themselves as moving forward through time. Further evidence has indicated that the relationship between spatial and temporal information is asymmetric where spatial information impacts temporal judgments to a greater extent than the opposite [4].

Construal Level Theory [1] outlines four key dimensions of psychological distance: spatial or geographic distance; temporal distance; distance between the perceiver and a social target, i.e. another individual or group; and hypotheticality, i.e. how likely, or certain, it is that an event will happen. It is thought that each dimension of distance is interrelated so that impacts on one aspect of distance can influence each other aspect of distance.

1.2 Current Research
Here, we explore the imagination of physical movement and location on a range of temporal perceptions and judgments. Psychological distance research implies that spatial distance may be related so that people who are further away may perceived greater temporal distance within related tasks. Furthermore, the embodiment literature indicates that people often consider temporal distance in spatial terms and therefore contexts in which an individual is spatially distant from familiar locations or is in transit may disrupt common ways of thinking about time.

2. METHOD
A total of 121 University of Nottingham undergraduate students participated in the online study. Participants were randomly allocated to one of three groups and were asked to imagine either being: at a home location, in transit, or being in a distant location. We tested that this actually happened by asking participants to write short vignettes. Participant reasoning and perception of time were then tested with a battery of temporal reasoning tasks.

Figure 1. Calendar task

The first reasoning task focused on how participants viewed the partitioning of the past, present and future. This was tested using the Cottle Duration Inventory [5], which allowed participants to define the present using temporal terms (e.g. "The present, as I think of it, extends from days ago to seconds from now"). Second, participants were presented with a 5-day calendar constructed to reflect a business work-week (see Fig. 1) and were asked to move

one meeting forwards and one meeting back. Participants were also asked a series of questions regarding their imagined content to ensure that it was consistent with the participant's experimental condition.

3. RESULTS

In order to ensure that the scenes imagined by the participants matched their condition, participants were asked post-experiment to rate their imagined scenario's distance from their home on a scale of 1-6 (1 signifying the shortest and 6 signifying the longest distance). A one-way ANOVA found that the participants rated distance differently between conditions ($F(2,118) = 54.26$, $p < .05$). Participants in the Home condition rated their scenarios as being their home or very close (mean = 1.75), those in the Distant condition rated "quite far" (mean = 4.93), and those in the Transit condition rated "neither close nor far" (mean = 3.6).

Analysis of the Cottle Duration Inventory task found that participants in all conditions tended to define the borders of the present symmetrically (i.e. the present runs from days ago to days from now). However, there were differences in the asymmetry of theirl answers (see Fig. 2 below). Participants in the Home condition were balanced in their positive and negative ranking ($Z = -.45$, $p = .653$) while participants in the Distant and Transit conditions were more likely to choose answers implying that the present extends further into the past than into the future (i.e. the present runs from days ago to seconds from now) This judgment was defined as "past heavy", while the opposite was defined as "future heavy". The differences between ranks in the Distant and Transit conditions were significant, ($Z = -2.952$, $p < .05$) and ($Z = -2.512$, $p < .05$) respectively

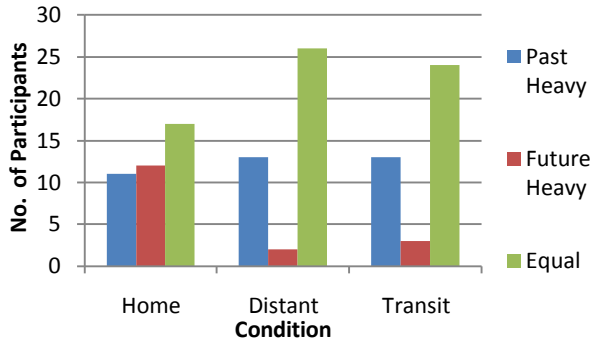

Figure 2. Cottle duration inventory results by condition.

The Boroditsky Monday-Friday task [3] was analysed to determine whether participants took an ego-moving strategy (i.e. viewing themselves as moving forward towards a point in time) or a time-moving strategy (i.e. viewing a point in time moving towards them). Responses received from the two questions pertaining to this task formed a reliable scale (Cronbach's Alpha = 0.756) and were thus combined.. An independent samples test found that while there was no difference between participants' responses in the Home and Distant condition ($t(158) = .034$, $p = .973$), both conditions differed significantly from the Transit condition ($t(155) = 2.934$, $p < .05$) and ($t(159) = 2.943$, $p < .05$) respectively (see Fig 3). In the Home and Distant conditions, participants were more likely to take an ego moving perspective whereas in the Transit condition, participants were similarly likely to take an ego moving or time moving perspective.

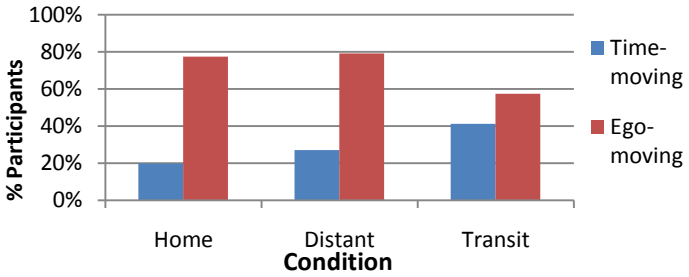

Figure 3. Recheduling task results by condition

4. CONCLUSIONS

Our results clearly indicate that an individual's location and state of mobility has a significant impact on the way that people perceive time. This has important implications for the way that people engage with regular tasks, such as scheduling diary appointments, when using mobile devices.

Responses indicated that participants investigated who imagined distant or transit scenarios perceived durations of time in a similar fashion and that this was distinctly different to how people who imagined a familiar home location perceived time durations. Participants in the Distant and Transit conditions both viewed the past as being further away than the future. We propose that during the priming task, participants in the Distant condition may have "mentally travelled" to their imagined location, thereby creating similar content to those in the Transit condition - both of these potentially containing a larger chunk of time having been experienced in the past. It may also be the case that Home participants imagined themselves as a passive part of the scenario while Distant and Transit participants saw themselves as taking a more active role, thereby changing their view of themselves in relation to time and space.

In line with hypotheses, it is also clear that participants who imagined travelling (compared to being at home or at a distance) experienced some form of interference that disrupted the way that they considered time during a scheduling task. However, differences observed were not in line with the findings of previous research. The fact that the results obtained so differed from expected (albeit in a clear and systematic way) demonstrates a need for further research in this area. It is hoped that ongoing research using actual rather than imagined primes will assist in clarifying these results.

5. REFERENCES

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