When Time is Space

Avinash Koyya
avinashk@iitk.ac.in
Dept. of CSE

Mentor : Prof. Amitabha Mukerjee
amit@cse.iitk.ac.in
Dept. of CSE
Indian Institute of Technology, Kanpur

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Abstract

People's understanding of the abstract domain of time, is dependent on the more experience-based domain of space. Further, it is people's representations of and thinking about their spatial experience that influences people's thinking about time (Boroditsky, Ramscar,2002)[2]. This project is to verify the flexibility of the conceptual projection of time into the Back-Front and the Right-Left representations and thus verify the related proposal by Santiago et.al.(2006) [1]. The results suggest a prevailence of visual congruency - when the motor response key is aligned to the visual location side of the phrase.

1 Introduction

How do we think, reason and represent abstract concepts ? Concepts like time. We tend to conceptualise the abstract domains based on analogy with those concepts that can be are perceived with a greater experience. Boroditsky, Ramscar(2002)[2] show how deep our representation of time is rooted in our bodily interactions in space by analysing how one's notion of movement in time changes with one's spatial condition and thinking. It is investigated that *thinking about abstract domains is built on representations of more experience-based domains that are functionally separable from representations directly involved in sensorimotor experience itself.* Also, that *people's thinking about time is tied to their thinking about spatial motion and not necessarily to the experience of motion itself.* The experiment they conducted (Figure 2), priming the subject by description of ego-moving perscpective (where one moves in time) as a person moving in a chair to his destination and time-moving perspective (where time is moving toward a static self) as a chair that has to be pulled to one's self, shows our ability to take both perspectives and to conceptualise about time in corresponding terms. The example shows flexibility of conceptualising time, varying over a object-ground ambiguation.

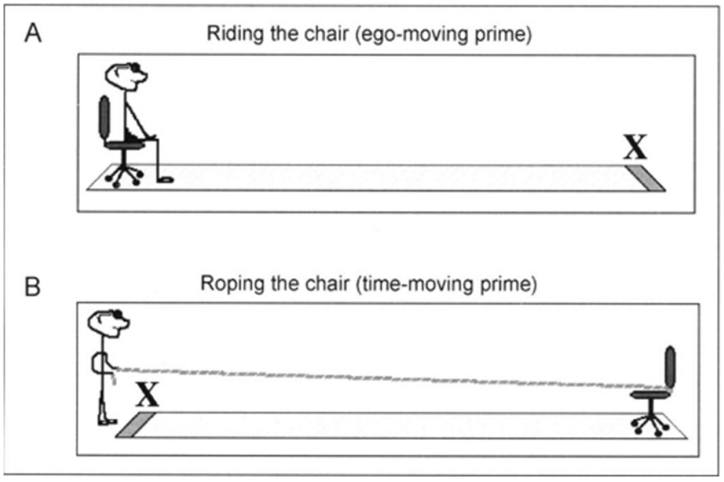


Figure 1: (a) ego-moving (b) time-moving primes

Languages show evidences in form of metaphors to the time-space mapping. The English language conceptualises the flow of time as movement from a past - behind to a future- ahead mapping. Ex. "*I am looking forward to meet you*", "*It was a tough time for us back then*". This might be due to the notion of moving forward in space. (There are exceptions. The Aymara language. [5]). In analogous to the notion of mental number line (Hubbard et.al., 2005) [3], there exists a proposal of mental time line (M. Bonato et al. 2012)[4], where time flows from the left(past) to the right(future) (Santiago et.al., 2007)[6].

The prevalence of these mappings are context dependent. Attentional factors are a key to understand such preferences. Despite the biases rooted culturally, (front-back by language), one tends to adapt to various mappings, depending on the context that demands attention to corresponding factors. In an experiment where the sub-

Figure 2: Trial sample - Front-Back incongruent and Left-Right congruent

ject has to choose between the front-back and the left-right model of time-space map, Santiago et.al. (2006) [1] show that the subject prefers the front-back model, in an allocentric frame, by default, but prefers the left-right model, in an egocentric frame, when his motor responses are involved. In this project, I conduct similar experiments.

2 Experiment 1

2.1 Participants

Seven undergraduate students of IIT Kanpur. All of them have been schooled with English as their first language.

2.2 Materials

Forty eight English phrases, as suggested in Santiago et.al. (2006) [1] were used (see Appendix).Twenty four referring to past and twenty four to the future. The experiment was conducted using an evaluation version of Eprime (http://www.pstnet.com/eprime.cfm).

2.3 Procedure and design

The experiment consisted of 192 trials. Each trail showed a fixation (+) for 750ms and then the target - a side-facing silhouette of a human face, with a thinking bubble containing the target phrase. The target phrases were ordered in random permutations of the 48 words, each occuring four times each a) left of a left-facing silhouette b) right of a left-facing silhouette c) left of a right-facing silhouette d) right of a right-facing silhouette. The participants were asked to say out loud “past” or “future”, depending upon the target phrase and simultaneously press a key (’1’) to indicate the time latency of the choice. This adjustment was done due to the lack unavailability of a vocal key to measure the response latency. The vocal responses were recorded by the software, using the audio input of the computer.

The trials are segmented into eight cases for analysis, based on the following factors - front-back congruent , lef-right congruent. A trial is front-back congruent if the bubble is in front of the silhouette for a target phrase future and at behind, for past. A trail is left-right congruent if the bubble is to the left of the silhouette (with respect to the participant) for a target phrase past and to the right, for future. The obtained response latency (time) and accuracy data was submitted to analysis.

3 Experiment 2

3.1 Participants

The same participants as in Experiment 1.

3.2 Materials

The same as in Experiment 1.

3.3 Procedure and design

The same as in Experiment 1. Except that the responses are now taken by key press (’1’ or ’0’). Note that the response key brings in the need to include Response congruency. The input is Response congruent if ’1’ is for past and ’0’ for future. In this experiment, the participants were asked to give their choices in Response congruence.

4 Experiment 3

4.1 Participants

The same participants as in the above experiments.

4.2 Materials

The same as in Experiment 1 and 2.

4.3 Procedure and design

The same as in Experiment 2. Except that, the participants were asked to give their choices in Response incongruence i.e., ’0’ for past and ’1’ for future.

5 Results

Data from two participants had to be discarded due to corrupted data files. Trials with response time latencies below 250 msec and above 2,500 msec were considered outliers and discarded from the response time analyses.

Time		Past		Future	
Left-Right Congruency		**Congruent**	**Incongruent**	**Congruent**	**Incongruent**
Front-Back Congruent	RT (% errors)	856 (7.5) 	885 (10.8) 	818 (10.8) 	830 (15) 
Front-Back Incongruent	RT (% errors)	846 (15.1) 	855 (20.8) 	832 (14.2) 	873 (15) 

Figure 3: Mean latency and % errors per condition in Experiment 1

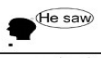
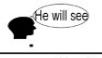
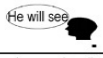
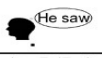
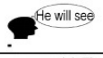
Response Congruency		Congruent				Incongruent			
Time		Past		Future		Past		Future	
Left-Right Congruency		**Congruent**	**Incongruent**	**Congruent**	**Incongruent**	**Congruent**	**Incongruent**	**Congruent**	**Incongruent**
Front-Back Congruent	RT (% errors)	983 (4.2) 	1017 (2.5) 	928 (1.7) 	942 (4.2) 	950(5.8) 	930 (5) 	827 (6.7) 	832 (7.6) 
Front-Back Incongruent	RT (% errors)	879 (9.2) 	973(9.2) 	936 (10.8) 	980 (11) 	896 (6.7) 	906 (6.7) 	852(7.5) 	898 (11) 

Figure 4: Mean latency and % errors per condition in Experiment 2 and 3

Experiment 1 holds up the argument that front-back bias may have affected the judgement of the participants. The error percentage is almost double for the front-back incongruent cases. Experiment 2 shows a general increase in response time over left-right incongruent trials. Experiment 3 also shows a general decrease in response time over left-right incongruent trials, thus suggesting a greater affect of visual and motor congruency. The participants may find it easy when the correct response key is on the same side as the bubble, in their visual field.

References

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