Chapter 9

An Experiment on Adaptation to Tactile Delays

Following a somewhat dazzling cruise through different issues concerning time and temporality on different levels and across disciplines, this chapter concentrates on a specific topic in the area of time perception: experienced simultaneity and its plasticity through adaptation to sensory delays. The topic is introduced in the light of the previous analysis, followed by the presentation of results from an experimental study on adaptation to tactile delays. This study had been conducted in collaboration with the CRED group in Compiègne. The experiment tests the hypothesis that time pressure is necessary to yield an adaptation effect. This hypothesis is based on previous research that has shown that adaptation to sensory delays only occurs in some experiments, not in others.

Given that the data presented in this chapter does not support this hypothesis, the experiment is difficult to interpret in terms of the problem of perceived simultaneity. However, in the light of the methodological theme of this book, it is worthwhile to present the research as an example for the practice of designing and conducting an experiment and engaging in complementary ER modelling. The following chapter presents the ER model of the experiment. The combined insights gained from the ER simulation model and its application to the experimental data are evaluated in the context of the preceding analysis of embodied time cognition in chapter 11.

9.1 Adaptation to Sensory Delays and the Experience of Simultaneity

In a recent study, (Cunningham et al., 2001a) report patterns of adaptation to artificially prolonged sensory delays in human participants in a visuo-motor task that are similar to those obtained in experiments with spatial displacement through prism glasses (e.g., Welch, 1978). Firstly, over training, the initially impaired performance is recovered and the annoying delay disappears from conscious experience. Secondly, re-adaptation to the normal...
condition is marked by a strong negative after-effect, i.e., participants’ performance on the unperturbed condition without delay is worse after training with a 200 ms visual delay. Although their study focuses on the behavioural aspects of the task, the authors report as anecdotal evidence that several subjects spontaneously reported that “when the delay was removed, the plane appeared to move before the mouse did – effect appeared to come before the cause” (Cunningham et al., 2001a, p. 533).

Such patterns of behavioural adaptation appear plausible in the light of the analysis given in the previous chapter. A recalibration of experienced simultaneity seems a logical reaction to the manipulation of the sensorimotor coupling. The rules of sensorimotor invariance that correlate with the experience of presentness are changed by means of the increased sensorimotor latency. A time span during which the subject cannot take further influence on a process it has initiated, for all practical purposes, does not exist ‘as a future’, and may just as well disappear from consciousness. Such a view corresponds well to (Libet, 2004)’s result about systematic neuro-behavioural latencies that the experimenter can observe, but that are, in contrary, not part of the subject’s own temporal experience. What is the use of perceiving that one is always a little bit late, if there is nothing one can do about it?

When the reverse manipulation is performed, i.e., sensorimotor latencies are shortened back to the original value, not only does the performance fall dramatically below the level initially measured without delays, also the experience of presentness is brought to a breakdown or into logical conflict. This reversal of perceived cause and effect appears reminiscent of Grey Walter’s results from the 1960’s (as reported in Dennett and Kinsbourne, 1992) about artificial shortening of inherent neuro-motor latencies. Walter brought the inherent neuro-motor latencies involved in motor decision making to the subject’s attention using real time brain computer interface, which leads the subjects to reject ownership of the consequent action, even though it is just minimally (hundreds of milliseconds) faster than the naturally executed action (cf. Sect. 8.6 in the previous chapter). Given these known patterns, why is (Cunningham et al., 2001a)’s result so surprising?

What makes (Cunningham et al., 2001a)’s findings so interesting is that, at several occasions, similar adaptation effects had been hypothesised, but had failed to occur. This repeated failure to obtain sensorimotor recalibration to sensory delays even led (Smith and Smith, 1962) to conclude that adaptation to sensory delays is impossible in principle. Also, following up on Cunningham et al.’s reported results, (Stetson et al., 2006) tried to reproduce the effect in a minimalist psychophysics set-up, but only produced partial readjustment of perceived simultaneity, which is of the order of magnitude (tens of milliseconds) of