

PERCEPTION-ACTION COMPATIBILITY

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Phase Transitions in Rhythmic Arm Movements Under Different Stimulus-Response Configurations

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By now, the characteristics of transitions in the phasing of human rhythmic movements are well documented, both for two limbs coordinated within a person as for two limbs between two persons. Recently, these findings were generalized to movements of a single limb (lower arm) coordinated with the motion of an externally driven visual signal. The objective of this research was to begin to uncover the nature of the informational basis of phase transitions of this type. Further explorations of this theme were carried out by manipulating the orientation of the signal to be tracked relative to the orientation of the movement. If the two orientations were exactly orthogonal, then no phase transitions occurred because in this special case the difference between moving out-of-phase and moving in-phase is meaningless (i.e., the information specifying the one mode is equivalent to the information specifying the other). In the experiments reported in this paper, the occurrence of phase transitions from anti-phase to in-phase movements was tested under various stimulus-response configurations: The orientation of the tracking movement was always horizontal (orthogonal to the gravitation field), while the orientation of the signal to-be-tracked was varied from a horizontal position (parallel to the tracking movement) to a vertical position (orthogonal to the tracking movement) with steps of 10° . Changes in the characteristics of the observed phase transitions, as well as the absence thereof in certain conditions, are interpreted in terms of the changing informational constraints on the two tracking modes. These changes in the informational constraints underlie the work space-dependent potential function that one would design to model the observed behavior purely operationally.

Non-Verbal Interference under Conditions of Compatibility Orthogonally Varied

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We investigated non-verbal interference with tasks using spatial relationships assuming a compatibility component in them. Arrows were used as stimuli and were shown at a position corresponding to either east, south, west, or north with the arrowhead pointing to one of these directions (congruent or incongruent). Control stimuli were either squares at these positions or arrows at positions irrelevant for any response mode. There were two tasks: answering the position or answering the direction, and two response modes: answering with a joystick or answering with keys arranged on a board in the cardinal directions. Thus two conditions of high compatibility (keys answering position, joystick answering directions) and two of low compatibility (keys answering directions, joystick answering positions = JP) were realized. In five experiments condition JP always yielded the fastest reactions, notwithstanding some interference by irrelevant direction. The remaining conditions ranked according to orthodox compatibility predictions. In addition, clear Simon effects (facilitation by irrelevant congruent position) showed up. This pattern of results remained unchanged when an irrelevant pre-exposure controlled for a hypothesized reaction towards the suddenly appearing stimulus, or when real movement instead of symbolic direction was used. All these results support the hypothesis that an 'affordance' is the base for the tendency to react towards the stimulus source and determines the perception of a position. Spatial compatibility effects may have their origin here.

Dimensions of Comfort Mode

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The concept of a comfort mode of activity is well accepted in everyday usage. But how this concept should be adopted into our scientific vocabulary is not clear at all. The difficulty is partly due to the flexibility that biological systems have in establishing comfort mode regimes. That is, what once was a difficult non-comfort mode activity can evolve into a comfort mode activity through time. What criteria should be used to define when a comfort mode has been achieved? Iberall defines comfort mode in terms of an absolute thermodynamic equilibrium framework: "a true 'comfort mode' should be something that can be maintained 'indefinitely', in practice for at least 3-5 hours". This definition, however, seems too strong to capture all comfort mode phenomena. That is, most everyday activities cannot be maintained for an 'indefinitely' long period of time. Different activities have different maintenance durations due to the specific task (e.g., complexity) and subject (e.g., learning) invariants. A research paradigm has been developed to explore the effect that these constraints have on establishing a comfort mode of activity. In the paradigm, action and perception are investigated in their reciprocal relationship by manipulating both the informational and the biodynamic constraints on the activity. We conducted a series of experiments that investigated the oscillation of short sticks of different lengths about the thumb and index finger using either haptic or haptic and visual information to control motion. Changes of the comfort mode régime were found with changes of stick length. But not all comfort modes were equally comfortable: (a) A 'global' comfort mode appears in the comparison of different stick conditions, and (b) the haptically controlled comfort modes were less stable than the haptically and visually controlled comfort modes. Further, limits were found on the establishing of the comfort mode at extreme stick lengths.

The Importance of Self-Perception in Coupling Perception and Action

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In recent years the compatibility of perception and action has had a lot of attention in the literature. What has become clear is that perception and action are mutually dependent, where perception subserves action and action influences perception: Neither can be described or defined independently of the other. Perception and action are said to be coupled through recurrent perception-action cycles in which action-relevant information is picked up by the observer. The perceptual information is both produced by and reciprocally used to regulate movement (Bootsma, 1988; Lee, 1983; Warren, 1990).

However, in this paper it will be argued that action-relevant perceptual information for coupling perception and action is not only movement-produced. Action-relevant information, at the same time, also specifies important body characteristics of the observer. Gibson (1979) first pointed out the importance of perceptual information of the self as a referential starting point for environment perception. The perceptual information to specify the self, including the head, body, arms, and hands, always accompanies the information to specify the environment. The two sources of information coexist. A number of experiments will be discussed in which perceptual information of the self is used in coupling perception and action.

OH, HOW I
HATE THESE
RT-EXPERIMENTS!



FROM THE LIFE OF A HOMUNCULUS