

Cognitive Control: By What or Whom?

“Systems” has been a central catchword in modern attempts to understand cognition. Cognition is a system, if not a system of subsystems (of sub-subsystems of ...). In more than one respect the systems notion turns out not to be overly precise. At least all parties seem to agree that the systematism depends on some constraints applying differently to what is within compared to what is outside the system. To understand cognition is to understand the bottlenecks that constrain the flow of information within the system in question.

Several cognitive systems have been suggested, in particular memory systems. Information is assumed to be processed in a short-term working



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memory system, recruited either from the external world through a sensory register, or from long-term internal information storage. Information is then processed and stored in different subsystems, each with somewhat different structural and functional characteristics, e.g. representational formats. The explanatory challenge is

to come to grips with the intriguing coordination that characterizes mental life. What binds all things together? How are information processing systems controlled? What prevents information processing activities from competing and contradicting one another?

Such questions are not new in psychology, although suggested answers have seldom been agreed upon. The suggestions have been sought from a variety of sources. For our purpose, let us focus on four lines of reasoning: about the question of agency, about control directions, about control levels, and about the nature of mental events. The answer we shall attempt suggests that a satisfactory solution to one of these questions must also answer the other three questions, and that all four questions must be treated together.

Traditionally the agency question has been mainly discussed within the psychology of personality. The research emphasis has not been on how a person controls mental events, so much as on attempts to understand what determines the formation of a person. The gambit has been an assumption that knowledge about this formation process would bring along knowledge about the person's agency functions. So far the knowledge about person formation is not impressive. With few exceptions theories of cognition leave out the person completely. Yet by more than common sense folk psychology one “knows” that persons are agents of cognition. What is more doubtful is how relevant studies of person formation will be

to answering the cognitive control question. A person may be responsible for his or her mental events without being responsible for his or her person formation.

The situation is different when it comes to the question about control direction. Although not much is to be found in current cognitive theorizing about the source of control, it is common parlance to specify whether the control is directed bottom-up or top-down. Alternative terms for the same distinction are “data driven” versus “conceptually driven”, or “sensory” versus “cognitive” processing. These distinctions make no commitments as to what or who is exercising the control, but implicitly suggest that there is not an abundance of possible control directions.

According to the theorists, apparently cognitive control might be found in stimulus conditions. Behaviourists have no trouble with this assumption. If not found there, it must be sought in the cognitive system. The Gestalt psychologists would agree on that. One cannot but wonder whether control after all must lie in coordination of the two control directions, which seems to be another way of saying that one cannot have directions without a source. The direction assumptions remain empty so long as the agency question is circumvented.

Control levels can be conceived of as levels of processing (Craik & Lockhart, 1972). Superficial registration of sensory task attributes demands less directed efforts than a deeper semantic processing. One sees the close relation to the directions interpretation of cognitive control. The level interpretation hooks up more directly with the energizing aspect of control, e.g. by effort assumptions.

The control we have referred to so far is hardly controversial, but not of much interest before it is made clear what is assumed to be controlled - presumably the units of cognition. However, what are the proper units of mental analysis is far from settled. Before we proceed further with the control question, consider three unit metaphors: points, connections and organisations.

One popular type of mental unit can be conceived of as constituting points in a mental space, e.g. ideas or concepts. Such units can vary in clarity or vividness, but scarcely along a dimension like truth. The strength of a unit of this kind may be measured by differentiation from other point units. Clear units stand out. Vague units dissolve into other units.

Strength interpretations favour connections as mental units. Most famous is the S-R unit. Associative strength, or in behaviourist terminology “habit strength” between stimulus and response, is supposed to be built up by gradual reinforcements, and presumably to be weakened over time. The strengthening process was assumed to be empirically demonstrated. The nature of the weakening process turned out to be far more difficult to determine. Associations connect, but can they (truthfully) represent?

Organisations have structure. The strength of an organisation reflects its structural features. A stable structure is more resistant to change than unstable ones. Organisations vary in structural goodness and complexity, not directly along strength dimensions. Complex organisations like scripts or texts can presumably represent, and thus be assigned, truth values.

Units like the three types mentioned have never been observed, and probably never will be. They function more like “mental models” for the theorizer, than as observational guidelines. Concepts like ‘percept’,

‘memory trace’ or ‘thought’ can be modelled as any of the three mentioned unit types. However, how one comes to theorize about perception, memory or thinking is not unaffected by one’s implicit or explicit unit modelling.

Those who subscribe to a mental philosophy that the complex must be explained by its constituting elements are inclined to base their research on what we have termed mental points or connections. Others believe that elements must be organised, e.g. to carry meaning. Their research will naturally be anchored in assumptions about structured units (cf. Thagard, 2000).

When one conceives of mental events in terms of points or connections (or similar entities), one is prone to seeing external forces working on mind. The processing is seen as bottom-up directed. The control is “of mind”. One can conceive of mind in terms of organisational units, and still believe that the control is external. But with this conceptual frame the chances are greater that mental life may be seen as controlled “by mind”. The organisational idea invites self-organizing interpretations.

Our three mental units urge a static conception of mind. Agents are analyzed into states described in terms of points, connections and organisations, where state changes are understood by reference to information processing by levels and directions. What if this somewhat static frame of reference is replaced with a more dynamic one? (cf. Juarrero, 1999).

Probably it is more correct to consider mental events as including the agent as a proper part, than to think of them as occurring “in” the subject (cf. Gallese & Metzinger, 2003). A mental event might for instance be described by reference to a series of attributes (e.g. agent, place, time, intentions, actions, main objects, ...) that vary along representational dimensions (e.g. having verbal, visual, motor or emotional values) and develop (change) over time (cf. Zacks & Tversky, 2001). At any point in time a mental event will have a certain organisational structure which produces informational feedbacks and feedforwards influencing its course (including “memories” and “plans”). Events of such complexity are scarcely “represented” in mind. They are probably simply unfolding. Mind is the going on of such events.

William James (1890) is well known for his “stream of consciousness” model of mental life. According to this line of thinking, mental life is never at rest, always in development. In the references made to the “stream of consciousness (SOC) model” the stream is tacitly treated as taking place within the person’s mind. Further, the SOC model is commonly interpreted as representing ongoing thinking, or ongoing perception, or ongoing memorizing, etc. In other words thinking, perception and memory are treated as elements of mind, elements that can occupy the mental slot called stream of consciousness. From a vantage point like this the stream of consciousness can rightly be questioned in terms of its control. The stream aspect is conceived of as a phenomenological experience, not reflecting genuine mental units.

We have suggested that mental life is a pulsating stream analogous to James’ SOC model (Helstrup, in press). But we believe that this stream is far from unitary. A number of processes is always going on. Some are very short lived. Others last for longer periods, and some for life-long stretches. At any time there are cognitive sub-processes starting up, terminating or in the process of development. As pointed out by Blumenthal (1977) there

will always be rapid integrations of such sub-processes. Blumenthal emphasized that integrations take place here and now across all forms of ongoing cognition. We assume that integrations will also take place over time, binding together intentions for the future with memories of the past, and binding these together with what is going on at present. The integrations are the organisational forces responsible for the structure of mind, perhaps in line with the suggested field forces of the Gestalt psychologists. Binding is the modern conception of integrative organisation (cf. Cleeremans, 2003).

Only a part of the processes that are going on will at any time be integrated, vertically and horizontally, and become manifested as conscious integrations that are experienced as the stream of thought. Most processes will be unconscious, but still be highly influential on cognition.

From this point of view the person is the mental integration that takes place. The person is not a static entity, but a dynamic process. The person seen in this way is partly self-organizing, and by feedback and feedforward able to influence the integrations that constitute the person.

Hence mental life is partly controlled by the unconscious mechanisms that are not manifested in conscious integrations. Partly mental life is controlled by the dynamic person. Personal control, in this sense, is dependent on well functioning mechanisms. There is no opposition between control by mechanisms and control by the person, since the person is part of the developing cognition. The control is not “in the person”. The person is (among many cognitive aspects) control. From this perspective the person is a controlling mind process, not a static substance controlling mind as a separate entity (cf. Prinz, 2003).

Cognitive control should thus not be seen as executed by separate entities. We are in control of mental life in terms of being persons, and we are persons in terms of the same control.

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