Conscious and unconscious components of intentional control.

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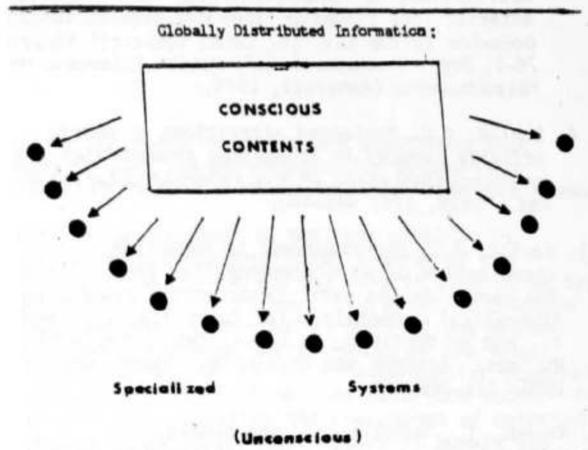
How is intentional action controlled? Other papers in this symposiums provide evidence for a style of motor control in which executives issue very general commands, which are interpreted "distributively" by intelligent specialized sub-systems, which are sensitive to local context. Likewise, there are classical suggestions that conscious components of intentional control serve an executive function, but without controlling motor systems in great detail: instead, the subsystems controlling actions interpret very simple conscious contents intelligently, with a view to local context (James, 1890). We suggest that there is much to be said for James' view of intentional control; further, his view fits a conception of conscious processes advanced by Baars (in press), suggesting that conscious representations are global, coherent, and informative in a nervous system consisting of distributed specialists which control all information processing details (Figure 1).

Table 1: Capability Constraints on a theory of conscious contents.

Conscious Processes	Unconscious processors
1. Computationally inefficient.	Highly efficient in specialized tasks.
2. Great range, & relational capacity.	Limited domains & relative autonomy.
3. Apparent unity, seriality, & limited capacity.	Very diverse, parallel, and together have great capacity.

Table 1 shows a set of widely-accepted facts about conscious vs. unconscious processes which fit this general view. Like conscious processes, entirely global processes are computationally inefficient because they require the cooperation or tacit consent of many other processes to remain global. They have great range of possible content since any specialist, or set of specialists has potential access to the global data base, and great relational capacity for the same reason. Global representations, like conscious contents, have apparent unity because internal contradictions would imply competition between different processors, which would destabilize the global representation; hence any competing representations must be displayed serially, and the global component would seem to have limited capacity. Similarly, the unconscious processors of Table 1 resemble the specialized processors of Figure 1. Though this is only a first-approximation model of conscious vs. unconscious activity, it will serve as a basis for approaching conscious vs. unconscious components of intentional activity.

Figure 1



Note that conscious contents are globally available, but most detailed information processing is performed locally by a large set of specialized, distributed processors. The specialized processors maintain the processing initiative.

Now consider the facts shown in Table 2 about contrasts between conscious and unconscious aspects of intentional activities.

Table 2

Conscious components	Unconscious components (*)
Problem assignment Problem solution (Aha!)	Problem incubation
Goal representation Goal feedback	Goal execution Open-loop adjustment of future actions.
Biofeedback signal	System controlling biofeedback.
Seriality of non-automatic tasks.	Parallelism of automatic tasks.
Stimulus for reflexes and externally-driven automatic tasks.	Detailed control of reflexes and automatic tasks.
Intentional modulation of reflexes and automatic tasks.	

(*) Some of these may be momentarily conscious, but too briefly to be retrievable subsequently.

Note first that in classical problem-solving tasks, the stage of problem-assignment --- the accumulation of constraints on a possible solution --- is conscious; however, all the detailed processes working toward a solution operate unconsciously, while the solution itself becomes conscious unexpectedly, as an "Aha!" experience. In intentional problem solving, the very fact that a goal is made conscious serves to trigger unconscious systems able to contribute to this goal. This fits the rough model of Figure 1, since distributed specialists can be triggered by a global display of a goal. These specialists then work locally on a solution, and can return a solution to the global display when they reach it. In the classical problem-solving case, the differences between conscious and unconscious parts are quite obvious; however, much the same components may also operate in other cases of intentional control, where they may occur much more quickly and less discretely.

For example in biofeedback training, a conscious feedback signal is triggered by an otherwise unconscious neural process. In itself, this is sufficient for intentional control of the unconscious process to develop. The model suggests that the feedback is "broadcast" globally, throughout the nervous system, so that one subsystem out of many millions that can control the feedback can "decide" to act whenever the feedback occurs. In this fashion, sensory feedback can come to control otherwise totally unrelated neural processes: thus, a feedback click can come to control a single motor unit (Basmajian, 1963), and the tast of saccharin can come to elicit suppression of immune function (Ader & Cohen, 1982).

The "executive ignorance" of conscious processes is not limited to new or exotic intentional control tasks. William James (1890), among others, has pointed out that "we" do not know in any detail how we do anything. One can account for this ignorance by assuming that we do not need to know anything: we can just know the goal consciously, and unconscious but very intelligent specialists will take care of execution of the goal.

Note also in Table 2 that feedback from an intentional action is conscious, a fact that presumably permits unconscious improvements in planning and execution to take place, in preparation for the next time that the action will be performed. This is especially true if there is a mismatch between the intended action and its performance.

But the case has so far been oversimplified. In fact, we cannot think of an action as being controlled by a single goal. Baars & Mattson (1981) maintain that an intention is indeed a multi-leveled goal structure, of which only a few goals tend to be conscious. The multi-leveled intention can be separated into presuppositions of the conscious goal, and subordinate systems involved in executing the conscious goal.

Further, practically all intentional actions consist of a continuous mixture of conscious and unconscious components. Generally speaking, most routine components tend to be largely unconscious, while those components that are new or involve some choice-point may be conscious. Thus, in skilled typing, we may be conscious of non-routine starting points of action, of input and output, and of attempts to override, modulate, or interrupt the typing task. Generally we seem to be unconscious of the mapping between letters and finger-strokes, of the details of motor control, and of highly repetitive input or output.

As we acquire proficiency in a task, it tends to become less and less conscious --- in terms of the model, it tends to be consigned to specialized, autonomous systems with fewer global messages. Schneider (1980) has found that tasks which are initially slow, serial and capacity-limited become increasingly fast, parallel and unlimited as they become automatic with practice. This is almost a perfec characterization of the difference between global and local processes in the current model.

Competition:

One of the most important properties of the model is that it permits competition; there is much reason to think that competition plays a central role in the control of intentional activity (Norman & Shallice, 1980). One can imagine a number of different kinds of competition in this model:

1. Conflicting intentions: intentions may be incompatible. In this, often the mismatching components seem to become conscious.

2. Conflict between superordinate and subordinate components of a single intention. This is typically the case with psychopathologies (see Table 3).

3. Conflict between an intention and its execution. Slips can be defined as actions that violate the actor's own expectations (Baars & Mattson, 1981). Slips often become conscious, perhaps because global broadcasting helps to recouple a previously decoupled goal component, whose absence permitted the slip to occur.

4. Conflict between intentions and external reality. And of course, sometimes the means needed to carry out an intention are unexpectedly unavailable.

Table 3

Perceived intentional vs. unintentional activities.

Intentional: Sense of some conscious control	Unintentional: Sense of no conscious control (*)
Most ordinary actions, thoughts, images, and feelings.	Actions: compulsions, undesired habits, slips, tics, speech defects, and addictions.
	Thoughts and images: phobic, obsessive, hallucinatory, anxiety-provoking, depressive.
	Feelings: anxious, depressive, etc.
Effect of "paradoxical intention" on unintentional activities	Resisted unintentional activities.
Success in well-known tasks	Failure in well-known tasks (TOT phenomenon)
Skeletal muscle control	Reflexes, autonomic functions, and automatic processes cued externally.
Internally motivated actions.	Externally coerced actions. Actions triggered by direct brain stimulation (Penfield & Roberts). Slips induced experimentally.
Activities whose pace is unforced.	Activities that are forced at a pace faster than normal.

(*) Some processes which do not yield a sense of conscious control may in fact be triggered by brief conscious contents that cannot be retrieved.

We suggest the following general conclusions, based on the material presented in Table 3:

Intentional activities appear to be triggered by conscious contents. Intentions are violated not only when the action is unexpected, but also when the subordinate system appears to resist control --- e.g. when it takes longer to find a certain word than one expects. This suggests that intentions carry information about the typical duration and difficulty of a known task. Further, it also suggests that "mental effort" occurs not as a function of the complexity of a task, but rather, as a function of the degree of perceived resistance to the intention, compared to the expected duration and difficulty of the task. This view may also help explain the related case of perceived coercion (a case of unintentionalness which is not just a political fact, but also occurs very often in our educational system). Such perceived coercion from an outside source may bring about a great deal of internal competition between systems attempting to exert executive control in a way that is insensitive to the demands of the subordinate system. One implication is that intentions, too, have their own "ecology": a successful intention must fit into the system as a whole, or competition will occur which will increase the perceived effort in carrying out the intention.

References

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