

# Automaticity and Processing Without Awareness

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**COMMENTARY ON:** LaBerge, D. (1997) "Attention, Awareness, and the Triangular Circuit". *Consciousness and Cognition*, 6, 149-181. (See also LaBerge's precis for PSYCHE <<http://psyche.cs.monash.edu.au/v4/psyche-4-07-laberge.html>>.)

## 1. Introduction

LaBerge (1997) proposed to define awareness as simultaneous activation of two triangular circuits, each connecting three brain sites, which are joined by a control area, in the prefrontal cortex. The activation of each of these circuits generates an "event of attention". One of these circuits provides a cortical representation of some "object" and thus is "object attended". The other represents the "self" and is therefore "self attended". The joint activation of the two circuits results in an "event of awareness". This use of the term awareness is much narrower than its common use. Furthermore, this definition of awareness distinguishes itself from some definitions of consciousness (i.e., the activity of cortical and thalamic structures, which results in a brain state of wakefulness (Baars 1995)), and in the distinction between two modes of conscious processing; with and without awareness. The purpose of the present commentary is to extend the analysis of LaBerge (1997) and to discuss the relations between his definition of awareness and the notion of automatic processing.

## 2. What is Automatic Processing?

Hasher and Zacks (1979), and Posner (1978) defined automatic processes as being effortless, unconscious, and involuntary. It is rarely the case however, for all three features to hold simultaneously (see Neumann, 1984; Carr, 1992; for reviews). Bargh (1989) pointed out that ballisticity (Logan & Cowan, 1984) - a feature of a process to run to completion once started, without the need of conscious monitoring - is common to all automatic processes, and proposed (Bargh, 1992) its adoption as the definition of automaticity.

Conscious monitoring in the definition above refers to the intentional setting of the goals of processing and intentional evaluation of its outputs. Thus, according to this conceptualization, a process is automatic if it has (due to genetic prewiring or due to routinization by practice) acquired the ability to run without monitoring. Tzelgov (1997b) pointed out that Stroop-like phenomena and (unintended) processing in the Exclusion condition of the Process Dissociation Paradigm (Jacoby, 1991) indicate automatic processing in this sense. Once a process has the feature of automaticity, it can act automatic either *autonomously* or "intentionally". Automatic processing is autonomous when it is not part of the task requirements, like in the case of "reading" the color word in the Stroop effect. It is intentional when it is a component of a more general task performed intentionally, like in the case of processing of the individual words when a sentence is read for meaning. It should be clear in this specific example that monitoring (*in the case of skilled readers*) applies to the processing of the sentence, while the components are processed without monitoring (see Vallacher & Wegner, 1987, for an extended analysis of these ideas).

This definition of automaticity does not imply that automatic processing is necessarily not controlled (see Logan, 1980; Tzelgov, Henik, & Berger, 1992 for examples of control of automatic processing). It also does not mean that automatic processing is always resource free (see Kahneman & Chajczyk, 1983; Paap & Ogden, 1981; for indications of the sensitivity of automatic processes to resources). Also, consistent with Holender (1986) and Velmans (1991), it does not equate automatic processing with the unconscious. I wish to argue however, that nonautomatic processing i.e., processing with monitoring, implies that the processed object is part of an "event of awareness", as this term is used by LaBerge.

## 3. Automaticity and Modes of Consciousness

While psychological processes may have subsymbolic components (e.g., see Van Orden, Pennington, & Stone, 1990), they return symbolic representations as their output. In my view, this distinguishes psychological processing from other biological processes. Like Dulany (1991), Holender (1986) and Velmans (1991), I believe that we are conscious of these representations, at least in the sense of supraliminal processing of the relevant

stimuli. I wish to emphasize that in my view, this is true for automatic and nonautomatic processing alike. In particular, while some (e.g., Marcel, 1983; Cheesman & Merikle, 1986) have argued that the Stroop effect - the paradigmatic example of automatic reading - can be obtained for subliminally presented stimuli, such results are hard to replicate. Recently, Tzelgov, Porat, & Henik (1997) have shown that the subliminal Stroop effect is constrained to participants who are able to perceive the word, and to trials in which the word is perceived.

Dulany (1991) proposed to distinguish between two modes of conscious process; he referred to them as evocative and as deliberative. The symbolic representations involved in and resulting from processing in the *evocative* have less than propositional form; they provide "a feeling of --" the represented object rather than a proposition defining it.

Processing in the deliberative mode acts upon, and results in, propositional representations. Nonautomatic processing characterizes the *deliberative* mode of consciousness. Monitoring, the defining feature of nonautomatic processing, applies to propositional representations. As pointed out by Tzelgov (1997b), while propositional representations are necessary for non-automatic processing, they are not sufficient. Monitoring, as the intentional evaluation of the processed content, also requires reflexive awareness (Dulany, 1996). Thus, being aware of, being aware of an output of processing in the present, allows comparing it to being aware of an identical/different output in the past (evaluating the outcomes of processing in comparison to its aims). It also allows for planning by being aware of a given proposition as referring to intended behavior. In addition, the monitoring agent (i.e., the self) has to be aware of it as being aware of the monitored outputs.

Recently, Dienes and Perner (in press) provided a detailed analysis of the relations between the awareness of the self and the awareness of the content the self is aware of. Thus, nonautomatic processing refers the subcategory of processing in the deliberative mode of consciousness. This subcategory refers to the monitored subset of the representations resulting from processing in the deliberative mode. I believe that this subcategory is equivalent to an awareness event as defined by LaBerge (1997). By contrast automatic processing refers to processing without monitoring of representations resulting from either the deliberative or the evocative modes of consciousness.

#### **4. The Two Circuits Definition of Awareness, and the Automatic/Nonautomatic Processing Dichotomy**

I propose that automatic processing, as defined above, reflects the activity of an "object attended circuit", without simultaneous involvement of the "self attended circuit". Let me use accessing the meaning of a visually presented word (e.g., "RED"). It may be hypothesized that, in the case of reading, the "object circuit" includes the left inferior prefrontal structure (see Carr, 1992), a control side in the prefrontal region of the cortex

and the relevant thalamic nuclei. When the word is read automatically, as in the case of the Stroop tasks, or when "RED" is a word in a sentence read for meaning, no "self attended circuit" is involved. Consequently, the reader is not aware of the word. It does not mean that the word is not consciously perceived. It also means that the word can, in principle, be attended. The output of the processing is in most cases, a "sense of" (Dulany, 1996) the meaning. It is "qualia-like", as is the term used for example by Banks (1996), although it may sometimes involve propositional representations.

Consider a case in which a person is responding (correctly) to the question of whether the visually presented sentence "Roses are red", is true. The words of this sentence are processed intentionally, and yet automatically, by virtue of being backgrounded to extracting the meaning of the word (see Jacoby, Levy, & Steibach, 1992). The person responding to the question has apparently, at least, a "sense of" the meaning of each of the words in the sentence, including "red", otherwise answering the question would be impossible. In fact it may be that processing of red results in a proposition relevant to the tasks requirements, such as red is the color of roses (see Tzelgov, Ganor, & Yehene, submitted, for a discussion of this issue).

Autonomous automatic processing is activated at the expression site by input from brain sites that process "lower level" information of the presented stimuli; perceptual and orthographic information in the present example. Thus it is assumed here that the process of (reading) skill acquisition results in generating connections between the control node of the circuit defining a given level of processing and the expression node in the higher level circuit. Thus, in this sense, autonomous automatic processing reflects activation of a given triangular circuit by "external sources" (LaBerge, 1997, p. 171). It is also worth noting that the evolution of these connections in the process of skill development results in defining the "default level of processing" (Besner, Stoltz, & Boutilier, 1997) which characterizes automaticity.

It makes sense to assume that intentional automatic processing as in the example above, may be receiving additional input to the prefrontal control node of the system. Such input apparently comes from another control node in the prefrontal cortex that joins two *other* triangular circuits; one object centered, the object of which is the sentence presented, and the other, self centered. Thus I'm suggesting here along the lines of the analysis of Vallacher and Wegner (1987), that the object of attention (i.e., whatever is monitored), reflects the task definition, in most cases.

Consider now a situation in which the word "red", that a bilingual person has never seen written in her second language, is presented to that person for the first time in her second language. The word is presented in isolation and the person is asked to read it. In this case, the task definition is accessing the meaning of the (new) word. It makes sense to assume that the reading of the word is now monitored. In this case, according to LaBerge's (1997) proposal, the self attended circuit is activated, in addition to the object attended circuit that focuses on the word, and the two circuits are "joined by a common control center" (LaBerge, 1997, p. 173). From my analysis, it follows that the reading process should result in a proposition "the read word means 'red'". Furthermore, the

reader *knows* that "the read word means red". In other words the simultaneous activation of the two circuit results in reflexive awareness (see Dulany, 1996, for a discussion), which is a prerequisite for monitoring. To be more specific, it is the self that monitors the processing of the "object". Bisiach (1988) refers to the access of parts of a system to its other parts as "monitoring of mental representations" and views it as one aspect of consciousness. This, in my view, is equivalent to the concept of awareness, as defined by LaBerge. What I'm suggesting is that awareness (as defined by LaBerge) indicates nonautomatic processing.

## **5. Summary and Implications**

LaBerge's analysis emphasizes the distinction between the notion of consciousness as a brain state of wakefulness, and awareness that refers to a specific "object" of processing. Awareness of an object is conceptualized as a neural event, which is a subset of a more general neural event that refers to that object - attending to it. Thus, one can think about a set of states nested within each other; awareness being a subset of attending, which in turn is a subset of consciousness. It should be clear however that awareness, as used by LaBerge, is a technical term and should not be confused with the everyday use of the word. I propose to equate awareness (as defined by LaBerge) of an object with nonautomatic (i.e., monitored) processing of it. Furthermore, I propose to equate automatic (*but conscious*) processing of an object with the activation of the relevant object-attended circuit or its component (see below). Such conceptualization of automaticity has several implications:

### ***5.1. The scope of automatic processing***

Because automatic processing is defined as processing without monitoring, it refers to whatever is processed at a given moment but is not part of an awareness event. Bargh (1997, see also Tzelgov, 1997b) pointed out that much, if not most, of psychological processing is automatic. The proposed conceptualization is consistent with this view. This applies not only to the perceptual, cognitive, and social domains, but also to the very process of learning. To be more specific, implicit learning may be automatic in the sense of being learning without awareness (see, Seger 1994). Once again, I wish to emphasize that awareness here has the very narrow technical meaning used by LaBerge.

### ***5.2. Automatic processing and the triangular circuit of attention***

This definition of automaticity also covers the condition in which all components of the triangular circuit of attention are activated. In other words, according to this definition and consistent with empirical data (e.g., Kahneman & Chajczyk, 1984; Paap & Ogden,

1981), automatic processing is not necessarily attention free. By contrast, LaBerge's (1997, p. 171) use of the term 'automatic' refers to conditions in which the activation of the cortical sites of attentional expression, by sources outside the system, is too short to generate the activity of the triangular site of attention. Thus, it is implied by LaBerge's analysis that only the expression component of the attentional triangle of a specific object is involved in its automatic processing. While this may be true in most cases, and is also consistent with the classic definitions of automaticity (e.g., Posner, 1978; Hasher & Zacks, 1977), I propose that the defining feature of automaticity is processing without monitoring, not processing without attention.

### ***5.3. Automatic processing and attentional control***

According to the proposed conceptualization, processing is automatic even in cases of attentional events (in LaBerge's terminology) that the person is not aware of (in the technical sense proposed by LaBerge). This implies that automatic processing can be controlled. There are both theoretical arguments (Neumann, 1984; Logan, 1985) and empirical data (e.g. Logan, 1980; , Tzelgov, Henik, & Berger, 1992) to support the claim that automatic processing is controlled. I believe that the attempts to define automatic processing as not sensitive to control were due to confusion between control and monitoring. One important aspect of LaBerge's analysis is his effort to clarify the distinction between attention and awareness (in the narrow sense of monitored cognitive processing), on both the cognitive and neural level.

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