Consciousness and Cognition 41 (2016) 177–188

Contents lists available at ScienceDirect

Consciousness and Cognition

journal homepage: www.elsevier.com/locate/concog

Conscious contents as reflexive processes: Evidence from the habituation of high-level cognitions

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ARTICLE INFO

Article history:
Received 4 September 2015
Revised 8 December 2015
Accepted 20 February 2016

Keywords:
Reflexive Imagery Task
Ironic processing
Habituation
Involuntary cognitions
Mind wandering

ABSTRACT

Reflexes are often insuppressible, predictable, and susceptible to external control. In contrast, conscious thoughts have been regarded as whimsical, 'offline,' and shielded from external control. Recent advances suggest that conscious thoughts are more reflex-like and susceptible to external control than previously thought. In one paradigm, high-level conscious thoughts (subvocalizations) are triggered by external control, as a function of external stimuli and experimenter-induced action sets. It has been hypothesized that these conscious contents are activated involuntarily and in a reflex-like manner. If such is the case, then these activations should possess a well-known property of the reflex: habituation. Accordingly, we found that involuntary high-level cognitions (subvocalizations) habituated (i.e., were less likely to arise) after repeated stimulation. As in the case of the habituation of a reflex, this novel effect was stimulus-specific. We discuss the implications of this finding for theories about consciousness and about psychopathological phenomena involving undesired, involuntary cognitions.

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Reflexes (e.g., the pupillary reflex) are often insuppressible, predictable, and capable of being controlled by external stimuli (e.g., light). Conscious thoughts, however, often seem to be shielded from such external control. While hearing a lecture, for example, one's conscious mind is free, in a sense, from the external stimulus (the lecture). It could be occupied, not by thoughts pertaining to the lecture, but by musings that are unassociated to the current environment. Similarly, when attempting to study a textbook, one might find oneself remembering a funny joke. Often, such thoughts arise out of the blue. These anecdotes suggest that the conscious mind is whimsical, unpredictable, 'offline,' and free from the reins of external control (Barron, Riby, Greer, & Smallwood, 2011; Shallice, 1972; Smallwood & Schooler, 2006; Wegner & Bargh, 1998). This widely held view, in combination with important theoretical developments (e.g., Fodor, 1975; Fodor, 1983; Schacter & Addis, 2007; Smallwood & Schooler, 2006), leads one to conclude that the generation of conscious thoughts is very different in nature from that of the standard reflex.

Contrary to this conclusion, some theorists (e.g., Freud, 1938; James, 1890; Miller, 1959; Vygotsky, 1962; Wegner, 1989) have proposed that conscious thoughts can arise in a reflex-like manner that is predictable and susceptible to external control *when* the appropriate conditions are present (see review in Allen, Wilkins, Gazzaley, & Morsella, 2013). Seldom are these conditions present in the uncontrolled physical environments of everyday life. With this in mind, it is worth considering that the reflex, too, requires certain conditions for its generation. Reflexes such as the pupillary reflex and the patellar reflex can

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http://dx.doi.org/10.1016/j.concog.2016.02.012
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fail to arise if, for example, one actively closes one eye or contracts the leg muscles, respectively. It has been hypothesized that the reflex-like nature of the generation of some conscious thoughts (or, more accurately, *conscious contents*; Merker, 2007) reflects the fact that, in most circumstances, the generation of conscious contents is 'encapsulated,' meaning that one has no conscious access regarding the workings of these generative mechanisms and that one cannot directly influence these mechanisms (Firestone & Scholl, 2014; Firestone & Scholl, in press; Merrick, Godwin, Geisler, & Morsella, 2014). This view of the generation of conscious contents is consistent with the historical idea that one is conscious only of the outputs of processes, but not of the processes themselves (Fodor, 1983; Lashley, 1956; Miller, 1962), as in the case of *unconscious inferences* (Helmholtz, 1856).

Perceptual mechanisms giving rise to illusions are often said to be encapsulated, because one's knowledge or beliefs about the true nature of the perceptual stimuli giving rise to the illusion cannot influence the illusion: One might know that the two lines of the Müller–Lyer illusion are equal in length, but this does not change in any way how the lines look in the illusion. In action control, the generation of urges, too, is often encapsulated. Consider, for example, when one attempts to hold one's breath while underwater, but one cannot 'turn off' the conscious inclination to inhale (Morsella, 2005). In general, action-related urges cannot be suppressed voluntarily, even when doing so would constitute the most adaptive course of action in a given situation (Morsella, 2005; Olsson & Phelps, 2004; Öhman & Mineka, 2001). These urges are triggered into existence by certain stimulus conditions. Often, the urges are less controllable than is overt behavior, leading to the insight that, although inclinations can be suppressed behaviorally, they often cannot be suppressed mentally (Bargh & Morsella, 2008).

The encapsulation of conscious contents is not limited to (relatively) low-level processes such as perception and action-related urges. As noted by Helmholtz (1856), it can occur for higher-level, non-perceptual processes such as automatic word reading. An unnatural and sophisticated process, word reading requires years of extensive training, and it involves multiple stages of processing. Helmholtz notes that, when an orthographic stimulus is presented to one, the stimulus automatically triggers a conscious representation of the phonological form of the word. For example, CAT yields /k/, /œ/, and /t/. In word reading, the visual stimulus (i.e., the orthographic stimulus) triggers a conscious content that is associated, not with the visual modality, but with audition (Levelt, 1989).

Ironic processing (Wegner, Schneider, Carter, & White, 1987) is another example of the generation of conscious contents from unconscious mechanisms that are susceptible to external control. This particular type of processing causes one to think about something (e.g., white bears) when instructed to not think about that thing (Wegner et al., 1987). In Wegner's (1994) model of ironic processing, the ironic effect arises from the interaction between two distinct mechanisms. One mechanism, known as the intentional *operating process*, actively seeks desired mental contents (e.g., to be calm). This particular operating process tends to be capacity-limited, effortful, and consciously mediated (Wegner, 1994). The other mechanism is an autonomous, *monitoring process*. This mechanism examines mental contents to identify specific contents that indicate a failure to maintain a desired mental state. Detecting contents that are incompatible with desired goals is imperative for successful cognitive control (Cohen, Dunbar, & McClelland, 1990). Once the monitor detects a content that conflicts with a desired state, then the likelihood of that particular content entering consciousness increases.

These two mechanisms normally function harmoniously. However, when the goal is to *not* activate a specific mental content (e.g., content *X*), then the interaction between the two processes leads to undesired outcomes, as in the case of ironic effects (e.g., the activation of content *X* in consciousness). This situation ensues because (a) the ironic monitor reflexively triggers into consciousness mental contents that are incompatible with the current goal, and (b) the operating process cannot actively preclude mental contents from entering consciousness (Wegner, 1994). Ironic effects are robust. Research has shown that even the threat of electric shock cannot pressure one into suppressing ironic thoughts (see discussion of relevant findings by McGranahan (1940), Sears (1943) and Wegner et al. (1987)). Most important for present purposes, in Wegner's (1994) model, that which causes the entry into consciousness of unintentional contents (i.e., the monitoring process) is an automatic, unconscious process that operates much as a reflex does.

Building on the research discussed above (i.e., Freud, 1938; Helmholtz, 1856; James, 1890; Miller, 1959; Vygotsky, 1962; Wegner, 1989) and on the experimental approaches of Ach (1905) and Gollwitzer (1999), Allen et al. (2013) developed a new paradigm, the *Reflexive Imagery Task* (RIT), which allows one to investigate how high-level conscious contents can be activated reliably and unintentionally through external control. In the most basic version of the paradigm (Allen et al., 2013), subjects are presented on each trial with the image of an object (e.g., a triangle presented for 4 s) after being instructed to not subvocalize (i.e., name in their minds but not aloud) the name of the object. Subjects fail to suppress such subvocalizations on the majority of the trials: 86% in Allen et al. (2013); 87% in Cho, Godwin, Geisler, and Morsella (2014); and 73% in Merrick, Farnia, Jantz, Gazzaley, and Morsella (2015). When this intriguing effect of involuntary subvocalization arises, it arises only moments (~2 s) after the visual stimulus appears (M = 1451.27 ms [SD = 611.42] in Allen et al., 2013; M = 2323.91 ms [SD = 1183.01] in Cho et al., 2014; M = 1745.97 ms [SD = 620.86] in Merrick et al., 2015).

For this covert, object naming response, perceptual and conceptual-semantic processing of a stimulus (e.g., the image of a house) must occur prior to the activation of the phonological form (e.g., /haus/) of the object name (Levelt, 1989). The consciously experienced form of the representation of the word, or, more accurately, of the phonological form (e.g., /haus/), can be construed as *action-related* because it is considered to be a '*sub*-vocalized' version of the word (Slevc & Ferreira, 2006; Vygotsky, 1962), which is isomorphic with what would be experienced auditorily if the word had been uttered aloud (Levelt, 1989). Consistent with this conclusion, in the speech production literature, subvocalizations are regarded as

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