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Consciousness and Cognition 13 (2004) 92–100
Consciousness and Cognition
www.elsevier.com/locate/concog

Availability, accessibility, and subliminal perception☆

1. Introduction

In some ways, the status of subliminal perception is the most problematic topic in the entire domain of the psychological unconscious. Predicted by Leibniz' (1704/1981) concept of *petites perceptions*, endorsed by Kant (1798/1978), and implied by Herbart's (1816/1881) limen, the phenomenon itself was first demonstrated by Peirce and Jastrow (1884) in a paper that probably counts as the first piece of psychological research to be published in America. In their research, they showed that observers could make accurate forced-choice judgments of relative weight or brightness, even though their confidence in these judgments was at zero—meaning, for all intents and purposes, that they were not conscious of any difference between the stimuli. Their findings were soon replicated by other investigators—so reliably that Adams (1957), reviewing the literature more than a half century later, wrote that "Behavior without awareness [i.e., of the kind demonstrated by Peirce and Jastrow] can be obtained even as a class exercise" (p. 388). After Peirce and Jastrow, subliminal perception was taken into psychoanalysis by Poetzl (1917/1960; see also Shevrin & Luborsky, 1961) and re-introduced to academic psychology by Bruner and his colleagues (Bruner & Klein, 1960; Bruner & Krech, 1950) as part of the 'New Look" in perception.

At this point, however, the evidence for subliminal perception was subjected to withering methodological critiques by Goldiamond (1958) and by Eriksen (1956, 1958, 1960). Among other things, Eriksen criticized the methods by which investigators established thresholds for conscious perception. But Eriksen understood that the real issue at stake was not really *subliminal* perception, but rather *perception without awareness*. In this respect, Eriksen argued that verbal reports were inadequate criteria for perceptual awareness, and asserted that awareness was more accurately reflected by discriminative behavior. But because discriminative response to a stimulus in the absence of verbal reports of awareness of the stimulus constituted the evidence for subliminal perception, Eriksen's critique had the effect of defining the phenomenon out of existence (Bowers, 1984).

Some proponents, notably Dixon (1971, 1981), attempted to bolster the case for subliminal perception, but the phenomenon was really rescued by Erdelyi (1974). In his landmark review article, Erdelyi showed how perception without awareness was allowed, if not mandated, by the

☆ Commentary on Erdelyi, M. H. (2004). Subliminal perception and its cognates: Theory, in determinacy, and time. *Consciousness and Cognition*, *13*, 73–91.

1053-8100/$ - see front matter
doi:10.1016/j.concog.2003.09.004

multistore information-processing models of attention and memory that dominated cognitive psychology at the time. Because these models implicitly identified conscious awareness with attention and short-term memory, to the extent that they allowed for preattentive processing they also allowed for some degree of perception without awareness. While Erdelyi argued for subliminal perception on conceptual grounds, the important empirical advance followed somewhat later with the work of Kunst-Wilson and Zajonc (1980), who demonstrated a subliminal mere exposure effect, and of Marcel (1983a, 1983b), who demonstrated masked semantic priming, both in a manner that was convincing to everyone—almost (Holender, 1986). More recently, Greenwald and his colleagues attempted to push the envelope of subliminality as far as possible, while simultaneously addressing the criticisms of Goldiamond, Eriksen, and Holender (Draine & Greenwald, 1998; Greenwald, Draine, & Abrams, 1996). In this most recent research, converging evidence from multiple experimental paradigms has persuaded everyone that subliminal perception is a genuine phenomenon (Merikle, Smilek, & Eastwood, 2001)—almost (Dulany, 1997).

2. Evolving definitions

One interesting feature of this history is how the notion of "perception" evolved. For Peirce and Jastrow (1884), perception was identified with sensation—and specifically, the difference threshold. Very soon, however, researchers began to tackle the absolute threshold (Dunlap, 1900; Perky, 1910)—and that, as Adams (1957) noted, is where things began to get complicated. Later researchers moved beyond the simple detection of sounds and lights to the more complicated perception of the shape or form of objects (Coover, 1917)—a tradition continued by Shevrin and Luborsky (1961) and by Kunst-Wilson and Zajonc (1980). Following Marcel (1983a), most recent research has focused primarily on the perception of words and their denotative (Cheesman & Merikle, 1984) and connotative (Greenwald, Klinger, & Liu, 1989) meanings. With "perception" defined in so many different ways, it is no wonder that there has been controversy.

So, too, the notion of "subliminal" has changed appreciably. Traditionally, a subliminal stimulus was defined as one whose energy level is too weak to permit conscious sensation. In their research, Peirce and Jastrow were really attacking the concept of the *limen* itself—the idea that there was some level of stimulus energy that was too weak to be picked up at the sensory surfaces, processed by the sensory system, and reflected in behavior. Some subsequent research often employed low-intensity stimuli, but the introduction of the tachistoscope changed the definition of a subliminal stimulus from one that was too *weak* to be consciously detected to one that was too *brief* to be consciously detected. Assuming that stimulus strength is some product of physical intensity and temporal duration, this still permitted investigators to talk sensibly about subliminality. But the next move, toward masked stimuli, altered the landscape considerably: in these experiments, the stimuli in question are "strong" enough, in terms of intensity and duration, to be consciously detected—if it were not for the presence of the mask. We tend to think of low-intensity, brief, and masked stimuli as functionally equivalent, all of them being "subliminal" in some sense, but it is not at all clear that this is the case. Never mind the differences between energy masks and pattern masks, forward masks and backward masks, peripheral masks and central masks, the reflected light of a tachistoscope and the emitted light of a computer display.

To make things even more interesting, Merikle and his colleagues (e.g., Cheesman & Merikle, 1984, 1985; Merikle et al., 2001) have drawn a distinction between *two* thresholds: the *subjective* threshold is the level of stimulus "strength" (however defined) at which detection drops to chance levels, while the *objective* threshold is the level at which all discriminative response drops to chance. Subliminal perception occurs in the area between the two thresholds, and is expressed by persisting discriminative responses to stimuli (or differences between stimuli) that cannot be detected. "Subliminal," then, means below the subjective threshold, but above the objective threshold. This makes it clear that the issue in subliminal perception is not really subliminality, but phenomenal awareness. "Subliminal" perception, where the stimuli in question are too weak (in some sense) to be consciously perceived, is then a special class of a broad category of phenomena which I have called *implicit perception* (Kihlstrom, 1990, 1996; Kihlstrom, Barnhardt, & Tataryn, 1992a). Based on an analogy to implicit memory (Schacter, 1987), we may define implicit perception as the effect on the subject's experience, thought, or action of an object in the current stimulus environment[1] in the absence of, or independent of, conscious perception of that event. The term *implicit perception* avoids the issue of subliminality, and makes clear that the real issue at stake is whether, and to what extent, there is perception without awareness; it also links unconscious perception to a broader class of unconscious phenomena legitimized by the wide acceptance of research on implicit memory.[2]

3. Absolute subliminality?

Against this background, Erdelyi (2004) seeks evidence of what he calls *absolute subliminality*, which amounts to perception of stimuli that are below the objective threshold for conscious awareness. Absolute subliminality is an interesting problem, because the very concept rules out the usual means by which subliminal perception has been documented. If subliminal perception is evidenced by discriminative responses to stimuli that are below the level of conscious perception, and the absolute threshold is the point at which all discriminative response disappears, then absolute subliminality is ruled out by Eriksenian fiat. Consider, for example, the study by Kunst-Wilson and Zajonc (1980), in which recognition was at chance but preference judgments favored subliminal stimuli. This is not evidence of absolute subliminality, as Erdelyi claims, because preference judgments are discriminative behaviors, and the absolute threshold is defined as the point at which all discriminative response disappears. Subliminal mere exposure effects take place in the gap between the objective and the subjective thresholds; but this is not *absolute* subliminality, as Erdelyi defines it.

Although Erdelyi declares that the subliminal perception controversy has been "finally settled" (p. 3) on the basis of Kunst-Wilson and Zajonc (1980) and other subliminal mere exposure

[1] Or in the stimulus environment of the very recent past, amounting to the "specious present" of James' (1890/1980) analysis of primary memory.

[2] I regret not having used the actual term "implicit perception" in my 1987 review article (Kihlstrom, 1987); but since its formal introduction (Kihlstrom, 1989, 1990, 1993; Kihlstrom et al., 1992a; Kihlstrom, Barnhardt, & Tataryn, 1992b) it seems to have caught on in both cognitive and social psychology (e.g., Bornstein, 1993; MacLeod, 1998; Neidenthal, 1990; Rossetti, 2001; Schweinberger & Stief, 2001; Wallace, 1994).

studies, he turns to memory for additional ostensible evidence for absolute subliminality. This tack is reasonable, in principle, because—setting aside questions of memory illusions (Roediger, 1996)—memory is a byproduct of perception. Therefore, the existence of a memory of an event implies that the event must have been perceived *at some level*. If an absolutely subliminal stimulus—i.e., one that does not give rise to discriminative responding of any sort—eventually emerges into memory, that stimulus must have been perceived. Although Erdelyi does not say so, this logic holds even if the memory in question is implicit (e.g., a priming effect) rather than explicit (e.g., recall or recognition).

Unfortunately, Erdelyi's argument is marred somewhat by an affinity for pseudomathematics (all those ηs and αs), which give off a little odor of scientism. But it is even more troubled by a fundamental confusion about the relation between *availability* and *accessibility*. As originally defined by Tulving and Pearlstone (1966), in a paper not cited in Erdelyi's article, availability refers to the presence of a memory trace in storage, a byproduct of encoding; accessibility, by contrast, is a product of retrieval. Their point was that available memories may or may not be accessible, depending on the conditions of retrieval. As Tulving and Pearlstone argued, the differences between free recall, cued recall, and recognition reflect changes in the cue-dependent accessibility of available memories (Tulving, 1974). The hypermnesia effects documented so well by Erdelyi himself in an earlier line of research (e.g., Erdelyi, 1996; Erdelyi & Becker, 1974) also have to do with changes in the accessibility of available memories. Memories can be accessible implicitly even if they are not accessible explicitly, and implicit memory effects give evidence that memories that are inaccessible to conscious recollection are available after all. In all these cases, availability is greater than accessibility.

Repeating an argument that he first made in 1992 (Ionescu & Erdelyi, 1992), Erdelyi asserts that the relation between availability and accessibility can reverse over time, so that accessibility can be greater than availability. But this does not make any sense, because accessible memories are a subset of available ones. Because availability puts an upper limit on accessibility, *by definition*, the relation between availability and accessibility can *never* reverse—not so long as these technical terms retain their widely accepted meanings. All that can happen is that available memories can shift between accessibility and inaccessibility (which is what forgetting is all about), or between inaccessibility and accessibility (which is what hypermnesia is all about), or between accessibility to conscious recollection and accessibility to priming (which is what implicit memory is all about).[3]

In any event, the evidence that Erdelyi offers for this reversal does not withstand scrutiny. In the one study he discusses at length, Merikle and Reingold (1991) conducted a subliminal perception experiment in which (here I am adopting Erdelyi's terms for purposes of argument) recognition judgments served as the measure of accessibility (in my terms, explicit or conscious perception) and contrast judgments served as the measure of availability (in my terms, implicit or subliminal perception). On Trials 1 and 2, recognition was at (or slightly below) chance while contrast was above chance, providing evidence for subliminal perception; as Erdelyi would put it, availability was greater than accessibility. On Trial 3, however, the pattern of data was reversed, with

[3] As a further example, consider the familiar library metaphor of memory, a reader can fail to access a book that is actually available on the shelves; but he cannot access a book the library does not own.

recognition above chance and contrast below chance. It is this pattern that Erdelyi interprets as accessibility being greater than availability.

Erdelyi may well be right to interpret the change in recognition as evidence of hypermnesia, but he misinterprets the change in contrast as evidence that availability and accessibility have reversed. Merikle and Reingold's result is a variant on the mere exposure effect (Mandler, Nakamura, & Van Zandt, 1987), and it is well known that exposure effects are greater with subliminal than with supraliminal stimulation (Bornstein, 1989, 1992). When subjects do not consciously remember test stimuli from the exposure phase, the processing fluency that comes with priming biases them towards primed stimuli when making stimulus-relevant judgments. But when subjects consciously remember the primes, they discount the experience of fluency and the exposure effect disappears. If, indeed, Merikle and Reingold's above-chance recognition results from hypermnesia, the attributional discounting that follows will lead to the disappearance, and even the reversal, of the exposure effect. Availability has not diminished, but the increase in (conscious) accessibility that comes with hypermnesia (if indeed that is what happened) has effectively abolished the exposure effect.

4. Subchance perception?

A similar discounting process can account for the appearance of "subchance perception" discussed by Erdelyi as further evidence for the "reversal" of availability and accessibility. Collapsing across Trials 1 and 2 in the experiment of Merikle and Reingold (1991), recognition is actually significantly *less* than chance, a result replicated by Van Zeist and Merikle (1993) and also observed by Greenwald, Klinger, and Schuh (1995).[4]

But how can recognition be reliably *below* chance levels? In order to understand what is probably going on here, consider a subject who is forced to choose which of two stimuli were presented previously as a subliminal stimulus. He has no conscious recollection of the stimulus (because it was presented subliminally), but (by virtue of priming and processing fluency) he finds that he likes one choice better than the other, or thinks that one has greater contrast than the other. Because the preference or contrast is a product of priming, the subject will be right more often than chance if he "recognizes" the one he prefers, or the one that seems to have greater contrast—or, put more generally, whichever one has more salience (Dorfman, Kihlstrom, Cork, & Misiaszek, 1995; Dorfman, Shames, & Kihlstrom, 1996; Kihlstrom & Dorfman, 2002, October; Kihlstrom, Shames, & Dorfman, 1996). But because the subject is not an experimental psychologist, he does not know this. Instead, he might quite reasonably conclude that salience is an illegitimate basis for making a recognition judgment. Accordingly, when forced to do so, he may well avoid the more salient option and choose the target that he *does not* prefer, or which has *lower* contrast. This is the wrong choice from the point of view of the experimenter, and yields to

[4] As Erdelyi himself notes, Greenwald et al. ascribed subchance recognition to measurement error. Although Erdelyi insists that the hypothesis of measurement error is an explanation of subchance perception, not a denial of subchance perception, it is in fact a denial. An observation that results from measurement error is not an observation that deserves any further consideration at all.

the appearance of below-chance recognition. This is the discounting effect in reverse, but it is not the same as a genuine reversal in the relations between availability and accessibility.

Erdelyi is quite right to interpret his hypermnesia results as evidence of unconscious memory that does not rely on the "dissociation" paradigm that distinguishes, for example, between explicit and implicit memory—a point he has also made previously (Erdelyi, 1996).[5] But in at least one sense hypermnesia is less satisfactory than explicit-implicit dissociation as evidence of unconscious mental states. When priming serves as evidence of implicit (i.e., unconscious) perception or memory, we can observe the unconscious mental state dynamically interact with the subject's ongoing experience, thought, and action. But no such observation is possible in hypermnesia: all we observe is that a memory that is consciously inaccessible on one trial is consciously accessible on the next. In the entire literature on hypermnesia since Ballard (1913), I think that there is no evidence of the dynamic activity of the unconscious memory on the subject's experience, thought, or action *while it is unconscious*. The psychological unconscious as the repository of latent percepts and memories is one thing; but as Freud well understood, it is the dynamic activity of unconscious contents that make them really interesting.

5. Was Freud right all along?

Which is not to say, as Erdelyi implies in this paper and elsewhere, that the existence of subliminal perception shows that Freud was right all along about unconscious mental life. Freud was certainly right to hypothesize the existence of unconscious mental states and processes, but that simple hypothesis was by no means original with him (Ellenberger, 1970; Whyte, 1960). What *was* unique to Freud was a particular description of unconscious mental life: that the unconscious was the repository of primitive sexual and aggressive urges; that unconscious mental contents were imagistic and nonverbal; that percepts, memories, and the like were rendered unconscious by virtue of repression; that unconscious mental contents emerge in dreams and can be revealed by symbolic interpretations; and so forth. In these respects, Freud appears to have gotten the facts entirely wrong (Macmillan, 1991/1997). Or, at the very least, contemporary research on subliminal perception provides no reason to think he was right.

Acknowledgment

I thank Philip M. Merikle for his comments on an earlier version of the manuscript.

[5] Erdelyi goes too far, though, when he argues that each successive recall trial recruit(s) a different psychological subsystem. Given the way that memory subsystems are defined in cognitive neuroscience (e.g., Schacter & Tulving, 1994; Schacter, Wagner, & Buckner, 2000), this is highly unlikely to be true. And it is a good thing, too, because while recall on Trial 2 might conceivably be mediated by a different memory subsystem than recall on Trial 1, things get worrisome when we consider a hypermnesia experiment that entails dozens of recall trials (Erdelyi & Kleinbard, 1978). The mind just isn't big enough to hold all those subsystems.

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