activation models of linguistic selection and sequencing. In: *Inhibitory Processes in Attention, Memory and Language*, ed. D. Dagenbach & T. Carr. New York: Academic Press, pp. 409–453.
Freeman, W. J. (2000). *How Brains Make Up Their Minds*. New York: Columbia University Press.
Freud, S. (1891). *On Aphasia: A Critical Study*. New York: International Universities Press, 1953.
Gainotti, G. (2000). What the locus of brain lesion tells us about the nature of the cognitive defect underlying category-specific disorders: A review. *Cortex*, 36: 539–559.
Goldsmith, J. A. (Ed.) (1990). *A Handbook of Phonological Theory*. Oxford: Blackwell.
Levelt, W. J. M. (1989). *Speaking: From Intention to Articulation*. Cambridge, MA: MIT Press.
Maquet, P., Peters, J., Aerts, J., Delfiore, G., Degueldre, C., Luxen, A., & Franck, G. (1996). Functional neuroanatomy of human rapid-eye-movement sleep and dreaming. *Nature*, 383: 163–166.
Maquet, P. (1997), Positron emission tomography studies of sleep and sleep disorders. *Journal of Neurology*, 244 (Suppl. 1): S23–S28.
Martinet, A. (1960). *Elements de linguistique générale*. Paris: Armand Colin.
McClelland, J. L., & Elman, J. L. (1986). The TRACE model of speech perception. *Cognitive Psychology*, 18 (1): 1–86.
McClelland, J. L., & Rumelhart, D. E. (1986). *Parallel Distributed Processing: Explorations in the Microstructure of Cognition*. Cambridge, MA: MIT Press.
Panksepp, J. (1998). *Affective Neuroscience*. New York: Oxford University Press.
Pincus, D. (2006). Who is Freud, and what does the new century behold? *Psychoanalytic Psychology*, 23: 367–372.
Pincus, D., Freeman, W., & Modell, A. (submitted). Perception in the clinical hour: A proposed neurobiology of transference.
Putnam, H. (1990). *Realism with a Human Face*. Cambridge, MA: Harvard University Press.
Saussure, F. de (1916). *Cours de linguistique generale*. Paris: Payot.
Shevrin, H. (1973). Brain wave correlates of subliminal stimulation, unconscious attention, primary- and secondary-process thinking, and repressiveness. *Psychological Issues*, 8 (2): 56–87.
Watt, D. F., & Pincus, D. I. (2004). The neural substrates of consciousness: Implications for clinical psychiatry. In: *Textbook of Biological Psychiatry*, ed. J. Panksepp. Hoboken, NJ: Wiley.

## Response to commentaries

Karen Klein Villa, Howard Shevrin, Michael Snodgrass, Ariane Bazan, & Linda A. W. Brakel

### PSYCHOANALYTIC AND COGNITIVE CONVERGENCES IN NONCONSCIOUS LEXICAL PROCESSING
### Response to Orsucci

We are grateful to the commentators for their scholarly and thought-provoking response to our target article and for the interesting theoretical and technical questions their response has generated. The Shevrin group has engaged in a long tradition of subliminal perception studies addressing a number of phenomena regarding primary- and secondary-process mentation, including physiological markers of unconscious conflict, affect, defense, and the attributional vs. relational nature of these two modes of processing. The current study focuses on the nature of language processing in the unconscious, where we hypothesized that words would be treated as perceptual stimuli and processed in a bidirectional manner. We sought to determine if the structural aspect of a lexical item was processed separately from its referent or semantic associate. This type of lexical modularity was postulated early on by Freud and has been outlined in contemporary models of language architecture. As stated previously, our palindrome finding did not emerge as a main effect; however, once the moderating variables of stimulus detectability and anxiety were taken into account, the perceptual treatment of words in the subliminal condition did emerge. In particular, high anxiety activated semantic associations and low anxiety inhibited semantic associations to the palindrome prime. We propose, therefore, that novel and creative sequencing of linguistic units (i.e., the word is treated as a perceptual object) predominates in unconscious cognitive processing and that this novel sequencing potentially contributes to ambiguity exploitation and resolution for such processes as condensation and displacement.

It is true that in understanding our findings, we integrated ideas and theoretical contributions from a wide variety of disciplines including psychoanalysis, psycholinguistics, cognitive neuroscience, experimental psychology (e.g., signal-detection theory), and neuro-

psychology. We recognize that there are significant and substantive differences between a cognitive unconscious and a psychodynamic unconscious. Specifically, the dynamic unconscious is a mental structure that is the seat of instincts, drives, and motivations and is subject to irrational mentation; whereas the cognitive unconscious refers to a type of indispensable, but rational, mental processing that occurs out of awareness, is automatic, and is not under conscious control. The dynamic unconscious and the cognitive unconscious, however, also share similarities in that dynamic concepts such as symbolization, condensation, displacement, and reversal resemble cognitive mechanisms such as conceptual metaphor, conceptual metonymy, conceptual blending, and irony (Lakoff, 1997). Our results support the notion that factors associated with personality, motivation, and affect, such as trait anxiety, impact the complex interplay between the mutual *cognitive* processes of facilitation and inhibition that characterize the central nervous system in general and are especially operative in primary-process mentation.

Lacan (1968) interpreted much of Freud's work on the unconscious and his explication of the "talking cure" to mean that the unconscious is largely constructed like a language and that the "laws of language" structure the operation of the unconscious with a functional distinction between "sign" and "signifier," or word form and word meaning. For Lacan, the elementary particles of language were phonemes that were related to one another along two fundamental axes of language: an axis of combination (i.e., syntagmatic; metanomy) and an axis of selection (i.e., paradigmatic; metaphor). On the syntagmatic axis, linguistic units are related to one another through temporal and spatial contiguity, and therefore the syntagmatic becomes an axis for combination; for the paradigmatic axis, linguistic units are related through association and selection such that one word can be selected over another but each could substitute for the other. Lacan suggests that these two principles of combination and selection form the foundation for the entire structure of language and, in the unconscious, are used for purposes of distortion such as in condensation and displacement (Ragland-Sullivan & Bracher, 1991). The results of our current study certainly outline the manner in which lexical modularity and creative syntagmatic sequencing operate in nonconscious processes and can be used in resolving lexical ambiguity.

Saussure, as referred to by Orsucci, emphasized that the relationship between the sign (sound image) and the signified concept was arbitrary; however, he also stressed that this system of signs was social in nature. Our commentator also refers to the Sapir–Whorf hypothesis, which posits a linguistic relativity in which the structure of language influences the manner in which a person understands reality and behaves with respect to it (Caroll, 1956). Recent research in the area of language development (Tomasello, 2001) has demonstrated that children acquiring language and the capacity for symbolization in the second year of life do so as a by-product of social interactions with primary caretakers in which they are attempting to understand and interpret the intentions of the communicator. During this period when experiences are registered in a largely implicit and procedural manner, young children are attempting to map "word to world" by perceiving and comprehending the intentions of their adult interlocutors. Therefore, language acquisition is not viewed as a purely mechanical process of apprehending an arbitrary set of symbols, but, instead, is done in an affective context in which the child is attuned to the referential intentions of others. While our research is not developmental in nature, we are suggesting that measures of personality and affective functioning are important variables influencing nonconscious cognitive processes such as language and symbolization.

Conversely, our results are consistent with Orsucci's suggestion (as according to Saussure and the Sapir–Whorf hypothesis) that language is an arbitrary and partially closed system of relations in which access to a simple lexical unit may function quite independently of its cognitive or referential meaning. The semantic associates to the reverse reading of a palindrome (e.g., DOG) were not idiosyncratic to the participant but allowed for access to a shared system of meaning; however, these results emerged only when individual-difference variables related to stimulus detectability and anxiety were taken into account. Certainly, our research demonstrates that individual differences may prove to be an important moderating variable in understanding nonconscious cognition. Theories of conscious and nonconscious cognition suggest that these processes emerge from the complexity of the central nervous system and the integrated dynamics of the brain such that they are subjective, phenomenological experiences of the individual. Our study attempts to outline the complex scientific and experimental tools necessary in assessing nonconscious cognition as both a global and an individual phenomenon.

Our results are also consistent with current linguistic parallel distributed processing models in which lexical access proceeds from visual feature/word detection through either a direct-access route (i.e., from orthography to semantic access) or a sublexical route (i.e., orthography to phonology conversion: OPC). We did not take into account in our analyses whether the relative

frequency (low vs. high) of the forward and backward reading of the palindrome prime impacted the semantic access, given that low-frequency words are "weakly" represented in the lexical route and may traverse the slower sublexical route (i.e., OPC route; Rapp, Folk, & Tainturier, 2001). We cannot from our results extrapolate the weighted balance between data-driven (i.e., bottom-up) processing and concept-driven (i.e., top-down) processing in visual word recognition. Orsucci raises the issue of whether we were able to consider the manner in which automatic associative processes and intentional contextual effects were taking place given our use of a priming paradigm with a lexical decision to a target–distractor pair. Prather and Swinney (1988) identify a temporal window for automatic associative priming in which these effects are largest at approximately 700 msec after the presentation of the word and passively diminish over time, being virtually gone by 2 sec. These researchers suggest that this is the time course in which a data base connected to the phonological/orthographic code and its close associates are activated. Our palindrome prime was presented for a period of 1 msec and then immediately followed for 3 sec by the target–distractor pair, thus falling within the window for automatic and associative effects to occur. The backward reading (i.e., palindrome) of the prime might essentially be considered the subordinate meaning in accessing associates to our structurally and semantically ambiguous prime and may, in part, account for the independent results relative to the forward and backward reading conditions. Patten & Kutas (1988) have researched ambiguity resolution using event-related potentials and have found that the N400 physiological marker (i.e., negative wave beginning around 200–400 msec after word onset) is closely linked with some aspect of word processing that is influenced by semantic factors. This evidence indicates that word recognition still proceeds in a strictly bottom-up, sensory fashion, but activation to higher-level syntactic and semantic levels of analysis is a subsequent and separate process that may overlap with initial bottom-up processes.

Finally, from a clinical perspective, language does provide a unique window into the processes of the mind, and the creative and *semantically ambiguous* nature of discourse provides rich clinical material necessary in developing insight and resolving unconscious conflict. Lacan, in his explication of the unconscious adhering to the "laws of language," indicates that the process of "working through" is to be found in helping the patient to pass from "empty speech" to "full speech" in which language becomes a conscious act of expression. Lacan suggested that contemporary psychoanalysis has focused too much on the analysis of resistance and should instead focus on the patient's use of the word, such that clinical symptoms are resolved when the correct word for the symptom is revealed indicating that the substitution is no longer necessary. For Lacan, this was the work of interpretation (Muller & Richardson, 1982), and we would hope our work on language in nonconscious processing directs clinical work toward this interrogative while also deepening our understanding of the cognitive unconscious.

*Karen Klein Villa*

## PRIMARY-PROCESS LANGUAGE
### Response to Pincus and Bonaventura

I am delighted by and very grateful for the interest and mental investment our paper has elicited in the different commentators. In what follows, I will mainly address Pincus and Bonaventura's various comments, which I was much stimulated by, but I will start by reacting to one of Erdelyi's concerns. Indeed, echoing his concern that the results are based on one experiment only, I want to add that in the meantime another experiment, with a similar structure, has been completed (Bazan et al., in preparation). In this new experiment, a subliminal prime such as, for example, DOOR was followed with a subliminal target consisting of a (phonological) palindrome of the prime (here ROAD) and either a distractor (e.g. LUNG) or a semantic equivalent (here, GATE). In this experiment we (twice) found the same effect: namely, the more the subjects rated themselves as anxious, the more they chose the phonological palindrome as a target; the less they rated themselves as anxious, the more they avoided the phonological palindrome. Moreover, ERP (event-related potentials) indicators unequivocally show that, though presented subliminally, the subjects registered the formal similarity between the prime and the palindrome target.

Pincus and Bonaventura raise some concern as to the linguistic model assumed by the paper. As a start, it might help if this model is briefly summarized.

First, as we are dealing with visually presented material, the model of most interest here is a model of processing *received* language, rather than a model of active language *production*—though it should be added that there is substantial overlap between the two (see e.g. Papathanassiou et al., 2000). This might be a first clarification as to the "ghost in the linguistic machine" concern of the authors. It is true that the experimental situation is reduced to a prosaic matter-of-fact description: words that did not have any other selection

criterion than their suitability for the (palindromic) experimental set-up were presented visually and as printed stimuli by *an* experimenter to *an* experimental subject. There were 50 subjects, and the experiment was fully controlled—that is, all the words (of which it might be suspected that they might interact at the level of their specific semantics with a specific subject in a specific interaction with the experimenter) were also presented in exactly the same set-up as control words. By subtracting control results from experimental results, it is assumed that one has effectively dealt with these very specific interaction effects and perhaps, therefore, with the ghost in the linguistic machine.

Second, the model used assumes that incoming linguistic information, such as the first letters or phonemes, are immediately used to generate a broad range of phonologically possible words (e.g., the Cohort model: Marslen-Wilson, 1990). These phonological alternatives, in turn, immediately activate associated semantic fields. When the language is received consciously, this happens very quickly—within the first 100 msec (Onifer & Swinney, 1981; Swinney, 1979)—and remains (mostly) completely unconscious to the subject, since after this short lapse a lexical decision is taken in accord with the syntactic and pragmatic context such that only one of the word alternatives is chosen. Moreover, psycholinguistic evidence shows that the nonsuitable alternatives are simultaneously actively inhibited (Gernsbacher & Robertson, 1995; Gorfein, Berger, & Bubka, 2000; Simpson & Kang, 1994), at least in the left hemisphere (Burgess & Simpson, 1988). In this specific case, the prime words remain completely unconscious ($d' = 0$), but our model assumes that they are fully capable of eliciting phonological associates and their semantic meanings. Moreover, since they are unconscious, these primes, in contrast with the supraliminal primes, are not subject to lexical decision and therefore able to prime a semantic associate of the palindrome of the prime, which is exactly what our results show: while forward priming works both supraliminally and subliminally, palindrome priming works only subliminally. The additional particularity of this study is the more radical assumption that phonological associates are not necessarily and not only generated upon a left-to-right reading of the word, but that, at the unconscious level, the phoneme sequence—in line with Freud's *Aphasia* model—can be considered an object, similarly to any other object, and therefore not tied to one particular manipulation direction. Indeed, the results show that it must be assumed that complete reverses of the words were at one point generated, if the priming is to be explained.

The following summary might help to address the Pincus and Bonaventura's concerns. First, they state that all linguistic models assume that an intentional connection between the form of the word and a meaning is created at the lexical processing level. We would like to point out that, while it is likely that intent intervenes at the level of the deciding lexical choice, a lot of lexical processes—such as lexical stem completion—are assumed to happen without this kind of control (e.g., see Barnhardt, 2004). A broad range of meaning-assignment processes occurs before this lexical decision point, but these are therefore thought to be nonetheless lexical. We are indeed in line with Caramazza's model (1996), where access to the bilateral semantic fields requires lexical word-form specification in the left temporal areas. Primary-process language is precisely assumed to be this language process that is not subject to lexical decision and associated inhibition of nonsuitable competitors, a process that is likely mediated by the prefrontal cortex (Chee, Sriram, Soon, & Lee, 2000; Poldrack et al., 1999). This is somewhat different from the commentator's wording of it: "primary processes would interfere with that assignment by forbidding the usage of the correct meaning of the word and by substituting that meaning with another." Primary-process language treatment is thought to happen anyway—that is, by default—and lead to a broad range of phonological (and semantic-upon-phonological) associations, and it is secondary processing that, by inhibiting the nonrelevant associates, enables a rational use of language (see also Bazan, in press). This secondary control here is obviated by the subliminal presentation, and thereby the primary process is uncovered.

The working hypothesis of the study, therefore, is *not* that meaning is not associated to word form in primary processes but, rather, that word form is not associated to *a particular meaning* in primary processes: in contrast with secondary-process language, in which word form and word meaning are solidly tied together (after lexical decision), in primary-process language, the word form has a high level of autonomy and can make associations with a broad variety of word meanings, without having to take the context into account. Therefore, far from thinking that language functions at a nonlinguistic level in primary process, we think that it is linguistic, in the sense of being processed at a phonological, lexical, and semantic level, but it escapes a particular processing stage by which language can function at the specifically symbolic level—namely, the lexical selection procedure, which needs the context to be taken into account. Therefore, primary-process language, while being linguistic, is functioning at what Freud calls the object level (more precisely, as a

graphemic and/or phonological object), and not at the reference level, where it has the capacity to refer to a specific meaning.

The commentators state that they would, rather, "see the primary processes as intervening at the level of the search of the meaning and of the generation of a meaning nonrelated to any actual, consciously selected word." We think this view is rather coherent with ours. In the linguistic model assumed by this paper, the incoming linguistic train elicits a range of phonological associates (and their semantic associates). Depending on the particular history and organization of the subject, some of these associates will have more emotional (or motivational) value than others. This model would be completely coherent with an assumption that these particular associates would then, for example, either persist longer or have more ramifications, generating an (unconscious) primary-process type of mental activity or thought. As the authors suggest, this could perfectly be envisaged as concurrent to (conscious) logical secondary processes and "might interact . . . by creating an *independent* relation of a meaning with a word."

Pincus and Bonaventura also express their concern as to how to resolve the psychoanalytic notion of primary process with affective consciousness/unconsciousness. It is to be expected that the presented words will interact with the particular psychodynamics of each subject, and it is therefore likely that the different subjects will react differently depending on the nature of the presented words. While we had no means to measure these specific effects in the current experiment, the stance taken in this paper is that besides these very content-dependent differences between conscious and unconscious language treatment, there are also more general *process* differences, which we have tried to uncover. It is to be expected that, dependent on the subject, some word forms will have more emotional value than others and will therefore elicit more (or less) of a response—which might be a way to conceive of the affective unconsciousness in this paper. This was not the specific focus of the paper. Rather, we wanted to make the metapsychological point that, at an unconscious level, language is treated as an object and that this is a general process, independent of the precise words involved. It should be added, however, that this process would not have been revealed in our data without taking personality factors into account such as (self-rated) anxiety or HOQ. But then again, note that it is not just, for example, high anxious people who show increased priming, it is also low anxious people who show *attenuated* priming (i.e., a significantly less-than-chance result), so that it has to be assumed that *all* participants had access to the palindrome reading of the prime at one point, but then reacted differently according to their personality.

Finally, I would like to react to Pincus and Bonaventura's last concern—namely, the lack of clear distinction between the dynamic unconscious and a cognitive unconscious. We think that the main point of this paper is the uncovering of a quite radical difference between the dynamic and any other conception of the unconscious: the fact that in the dynamic unconscious the word form acquires a relative autonomy from the word meaning, that at that level it functions as a (graphemic and/or phonemic) object similar to any other object—that is, by virtue of its formal attributes.

*Ariane Bazan*

## CATEGORIZATION MATTERS
### Response to Compton and Erdelyi

I, too, want to thank all of the commentators for their careful consideration of our complex work as is reflected in their perceptive comments. That said, I want to explain that I shall not be addressing these comments in particular but will, instead, focus on a general matter that is, directly or indirectly, at the center of all four discussions: the status and nature of the various categorizations our experiment presumes.

The experiment itself essentially concerns whether words presented subliminally at the objective threshold and functionally unconscious are categorized in a primary-process fashion (i.e., as printed physical objects) and treated as such, or categorized in the ordinary secondary-process fashion (semantically as words) with secondary-process mechanisms predominating. Beyond this, however, are two sets of more basic categorization questions: First, *how* do we categorize "unconsciousness" vs. "consciousness"? How do we make this distinction? And similarly, *how* do we categorize the primary processes vs. the secondary processes? Second—an even more fundamental pair of questions: Can we make the sharp distinction we do between what is categorized as conscious vs. unconscious? Likewise, are the categorical distinctions we make between primary and secondary process warranted?

I shall take up these two sets of foundational questions, as the discussion of the experiment's main categorization question has already been addressed quite ably by my coauthor colleagues. The answers to the set of *how* questions—How do we categorize "unconsciousness" vs. "consciousness"? How do we categorize the primary processes vs. the secondary processes?—can be found in the actual methodology of the experiment.

Regarding unconsciousness vs. consciousness, the objective threshold has been established as the duration (1 msec, given the other conditions of our equipment in the experiment) at which participants have no conscious awareness of presentations of stimuli. (For a complete review of the relevant experimental literature, see Snodgrass & Shevrin, 2006.) Contra Erdelyi, there is no confound here. There is no awareness at 1 msec—no primary consciousness, no secondary (reflective) consciousness, no consciousness at all. So exploring (under our experimental conditions) exposures of 1 msec *with awareness*, in an attempt to address the putative confound, is just not possible. (Here is an analogy. Suppose $H_2O$—water—is taken to 32° F. It freezes and has properties consistent with $H_2O$ in its frozen solid state. But then suppose someone suggests that you study the effects of a temperature of 32° F on $H_2O$ independently of the properties $H_2O$ has in its frozen solid state.) To return to *how* we categorize unconsciousness, it is in this operational fashion. We consider subliminal presentations at 1 msec (given all the other experimental conditions as specified) to be functionally unconscious, whereas the supraliminal presentation we consider to be in functional consciousness. This is *how* we have categorized unconscious/conscious in much of our experimental work.

Turning to the *how* question regarding the categorization of primary process vs. secondary process, the distinction again is made methodologically. A certain type of response—attributional/palindromic/word-as-physical-thing (printed-item)—is *presumed* to index the primary process; another type of response—relational/semantic/word-as-representational symbol—is *presumed* to index the secondary process. Now I stress "presumed" because in every experiment there is something taken as true or assumed, without which the experiment could not progress. In the case of the primary- vs. secondary-process experiments conducted over the last decade in our laboratory (Bazan, Brakel, Winer, Kushwaha, Snodgrass, & Shevrin, in preparation; Brakel, 2004; Brakel, Kleinsorge, Snodgrass, & Shevrin, 2000; Brakel & Shevrin, 2005; Brakel, Shevrin & Villa, 2002; Camaj, Snodgrass, Shevrin, & Brakel, in preparation; and the current study) the indexing function of attributional and relational responses for primary and secondary processes, respectively, *is* that assumption. Assumptions such as these can and should be evaluated. In our case, the use of attributionally organized responses as an index for primary-process responses has three things to recommend it. First, attributional organization, as described in cognitive-psychology terms without any psychoanalytic presuppositions, is independent from psychoanalytic concepts and yet maps quite well onto an essential formal feature of primary-process organization, as described psychoanalytically. This independence is necessary for a good index. Second, the index appears reliable. In the two series of experiments in which, according to psychoanalytic predictions, the primary processes should predominate (Shevrin, 1973; Shevrin & Fisher, 1967; Shevrin & Fritzler, 1968; Shevrin & Luborsky, 1961; and Brakel, 2004; Brakel & Shevrin, 2005; Brakel, Shevrin, & Villa, 2002; Brakel et. al., 2000), attributional organization was, in fact, found to predominate. Third, that these findings are from studies in disparate areas not only provides evidence for Freud's basic assumption that there is a primary-process mode of thinking (the testing of which was our goal), but also lends support to the method of using attributional organization as an index. (For a more complete discussion, see Brakel, 2004.) Thus, again we answer the *how* question methodologically. Using attributional responses as an index for primary process and relational responses as an index for secondary process, we have made a sharp categorical distinction between primary process and secondary process.

Now onto the most basic set of questions: Can we make the sort of categorical distinctions we have made between unconsciousness/consciousness and primary process/secondary process? Yes, we can methodologically, as discussed above. And this holds up epistemologically, too, in the following way. We can know that participants in our experiment under certain conditions have some conscious awareness of the presentations and under other conditions have none. And we can know that some set of their responses conform to primary-process principles and others to secondary-process principles. But what about ontologically: do such categorical dichotomies really exist? Well no, not if you look at particular events. Suppose that I am X-ing at time *t* and that I am reflectively aware of doing so. There are always primary- and secondary-process operations going on. Also at time *t* I am not merely reflectively conscious of X-ing; I am simultaneously conscious in a nonreflective, primary way of many things. Moreover, and still at time *t*, there are always occurrent (not merely dispositional) unconscious processes comprising my X-ing too.

So does this deny the categorical distinctions ontological standing? I am not convinced—even granting that in nature during any particular event one probably can find neither pure culture unconsciousness or consciousness, nor pure culture primary- or secondary-process operations. For after all, there are probably no natural free-living kidney cells or esophageal sphincters either, not to mention mitochondria and cell

membranes existing independently. And yet we would not deny these organ-parts and cell-parts ontological standing. Returning, then, to the categorical matters at hand—unconscious/conscious and primary process/secondary process—we may not be carving things up just as they are ontologically, but in experiments such as this we are trying for a closer approximation.

*Linda A. W. Brakel*

## OBJECTIVE THRESHOLDS ARE ALIVE AND WELL
### Response to Erdelyi

As is his wont, Erdelyi brings up many important and interesting points in his commentary—many more, unfortunately, than can be adequately discussed here, given space limitations. Accordingly, I shall largely confine myself to the key issue of exclusively bidirectional (including below-chance) effects and their implications, particularly with respect to the concept of the objective threshold and its role in inferences for unconscious effects Along the way, I shall briefly address qualitative differences and their interpretation. Before proceeding, I should note that Erdelyi's comment that we did not discuss his earlier (2004a) reservations about objective thresholds and bidirectional effects in the current target paper puzzled me, because we have already done so previously (cf. Snodgrass, 2004). Rather, it is Erdelyi (e.g., 2004b) who has yet to respond to our latest comments; instead, he now (this volume) essentially reiterates his earlier concerns. My response here, then, essentially expands on ideas first presented in Snodgrass (2004).

At the outset, let me clarify that by "bidirectional" I am not referring to which direction the words are read (i.e., bidirectionality as it pertains to obtaining both forward and backward effects), but, rather, to the striking fact that the current subliminal effects, both forward and backward, do not manifest as overall (i.e., unidirectional) mean effects. Instead, they are *exclusively bidirectional*. That is, even though the overall means for both the forward or backward priming conditions are right at chance, which would usually be taken to indicate no effects at all, there are nonetheless systematic effects present—but affecting the *variance*, not the overall mean (cf. Katz, 2001). In the current data, trait anxiety (for both conditions) and the HOQ (for forward priming) mediate performance such that some participants facilitate whereas others inhibit. Notably, the latter effects are particularly striking because they apparently reflect autonomous unconscious inhibitory processes.

Considered only by themselves, however, these effects do *not* force interpretation in terms of unconscious perceptual influences (because they occur on an indirect rather than direct task; see below). Rather, the primary evidence that these effects are indeed unconscious is provided by the separate finding that overall detection $d' = 0$, and additionally buttressed by detection $d'$'s negative correlation with the anxiety effects. Erdelyi, however, objects that perhaps exclusively bidirectional effects underlie all apparent demonstrations of objective threshold (here, detection) status, and he claims that this would vitiate their inferential power. To address this concern requires a closer look at objective thresholds, direct vs. indirect tasks, and exclusively bidirectional effects.

#### *What do exclusively bidirectional effects imply?*

In their exclusively bidirectional structure, the current effects strongly resemble those from our pop/look paradigm (see, e.g., Snodgrass & Shevrin, 2006), in which participants attempted to identify subliminally presented words (also 1 msec). Analogous to the current findings, overall identification performance was right at chance, but bidirectional effects (as a function of task strategy and preference: the details of this are not important now) were nonetheless observed, again including both above- *and* below-chance performance. Moreover, and crucially, in the pop/look paradigm the experimental task was *direct*—that is, rather than examining the (indirect) effect of the subliminal stimuli on some other task, as in the current study, pop/look participants were asked to respond directly to the subliminal stimuli themselves.

The direct nature of the pop/look identification task is important because a cardinal and extremely well-supported assumption of psychophysics is that participants can and will use whatever conscious perception they have to respond *as instructed* on such tasks. Given the typical instruction to answer correctly, this means that if conscious perception is present, above-chance performance will result (particularly if forced-choice tasks that avoid response bias are utilized, as in the pop/look paradigm)—that is, *unidirectional effects will manifest*. Conversely, participants can answer incorrectly if so asked, producing unidirectional below-chance effects. Either way, the essential point is that under normal circumstances participants can and do voluntarily control their responses to consciously perceived stimuli, thus producing unidirectional effects in the intended direction. This also implies that if such unidirectional effects are absent, relevant conscious perception is absent as well. If so, *exclusively*

*bidirectional effects on direct tasks are not conscious*—they must be, rather, the result of unconscious perceptual influences that, additionally, are not consciously controllable. If they were, unidirectional facilitation would manifest instead. Incidentally, it is important to note that unidirectional and bidirectional effects are independent, and can co-occur. For example, one could observe both an above-chance mean (the unidirectional component) and bidirectional effects around that mean as well. With this in mind, only exclusively bidirectional effects on direct tasks are necessarily unconscious (i.e., when, additionally, unidirectional effects are completely absent).

### *Further reasons to believe that exclusively bidirectional effects on direct tasks are really unconscious*

For starters, there are strong reasons to believe that below-chance effects are unconscious, simply because if they were conscious, participants would use that information to perform above, not below, chance. Erdelyi himself has little to say about how below-chance effects could be conscious, but perhaps implicitly he endorses the account given by Kihlstrom (2004; see also Bachmann, 2004). These authors' scenarios could be called "spontaneous-exclusion" hypotheses. The idea is that the below-chance participants are experiencing their (by this account, conscious) perceptions of the words as strange or anomalous and spontaneously reject these perceptions.

At first glance, this may seem a reasonable possibility. There are two fatal difficulties with this account, however. First, there is extensive experimental evidence from *exclusion paradigms* (e.g., Merikle, Joordens, & Stolz, 1995) showing that participants do *not* exclude (i.e., inhibit) responding with just-presented masked words, *even when explicitly instructed to do so*. Instead, they facilitate—that is, exhibit exclusion failure. Moreover, these exclusion-failure effects occur under subjective threshold conditions, which utilize much stronger stimuli than our objective threshold conditions. Indeed, participants do not succeed in voluntary (i.e., instructed) exclusion until stimulus strength exceeds the subjective threshold—that is, are clearly conscious. These data strongly suggest that consciously controlled exclusion is a criterion-based decision process; hence, although above-criterion stimuli are excluded, below-criterion stimuli are not, even when instructions require it (cf. Snodgrass, 2002). Only when strenuous additional efforts are made to induce liberal exclusion criteria does exclusion success finally occur, and even then performance is at—not below—chance (see Visser & Merikle, 1999). With all this in mind, the spontaneous-exclusion account for the below-chance effects in question is simply untenable, and strong reasons remain for inferring that they indeed reflect unconscious inhibition.

But what about the other, facilitatory half of the bidirectional effect? Might that be conscious? One major problem with this notion is that the facilitation effect in the pop/look paradigm is negatively, not positively, correlated with detection (Snodgrass & Shevrin, 2006). In contrast, there is massive evidence from signal detection theory (SDT; see Macmillan & Creelman, 1991) that *unidirectional* detection and identification performance are tightly, highly, and positively correlated (see also, e.g., Haase & Fisk, 2001; Haase, Theios, & Jenison, 1999). Moreover, along the same lines, analogous SDT evidence suggests that identification effects of any kind whatsoever (i.e., either above or below chance) should simply not be possible when detection $d' = 0$, which it is in the pop/look paradigm. These constitute very strong qualitative differences against a conscious perceptual interpretation. In contrast, Erdelyi, when he criticizes qualitative differences, sets up a straw man (i.e., his scotopic vision example). As I argued in Snodgrass (2004), however, qualitative differences are strong only when there is good evidence regarding how the relevant measures relate when stimuli are conscious, which then (and only then) makes it possible to potentially show important differences under ostensibly unconscious conditions. The qualitative differences just discussed meet these conditions: The relationship between detection and identification when stimuli are conscious is very well established, holds across all known (undirectional) positive $d'$ values, and is clearly monotonically positive. Given these facts, the negative relationship in the objective threshold region is very strong indeed.

### *Putting it all together*

All in all, then, there are strong reasons to believe that unidirectional effects on direct tasks reflect conscious, controllable perceptual influences, whereas exclusively bidirectional effects on direct tasks, in contrast, reflect unconscious, uncontrollable influences. With this in mind, when Erdelyi says, "There is nothing absolute or objective about the 'objective threshold,' $d' = 0$, since the existence of *both* positive values . . . and negative values . . . means that the 'objective threshold' . . . might arise from the averaging of positive and negative values', he simply misses the point. The real meaning of the objective threshold is, and always has been, that there are no *unidirectional* effects on

$d'$—that is, that overall $d' = 0$—because this ensures what we want (i.e., the absence of conscious perception). Accordingly, the objective threshold is indeed absolute and objective in precisely the sense we wish it to be. Contra Erdelyi, exclusively bidirectional effects are not intrinsically problematic; rather, they would pose difficulties only if they are conscious, which the above considerations militate strongly against.

*But what about time effects?*

The above discussion deals with bidirectional effects obtained in the same time period. Erdelyi (2004a) has also suggested that facilitation and inhibition could vary importantly across time, in his view perhaps again averaging out into another ostensibly specious objective threshold. However, although this is conceivable, there are no data as yet to support Erdelyi's conjecture with objective threshold conditions (e.g., there are no time effects in the pop/look paradigm; see Snodgrass, 2004), which Erdelyi (2004b) acknowledges to some degree. In contrast, however, there are data to support substantial time effects when stimuli have been initially consciously presented or subjective threshold conditions have been used (see Erdelyi, 2004a; Snodgrass, 2004). Even here, however, none of these data have shown reliable below-chance inhibition at any time, notwithstanding tantalizing hints of such effects.

*Application to the current effects*

The above considerations suggest that there are strong reasons to believe that the current backward and forward priming effects are indeed unconscious. Overall direct detection $d'$ was right at chance, independently demonstrating the absence of undirectional facilitation and hence the complete absence of relevant conscious perception. Contra Erdelyi, the possibility that detection itself might additionally harbor exclusively bidirectional effects does not threaten these conclusions, because there are strong reasons to believe such effects are themselves unconscious. And again, these conclusions are further reinforced by the negative relationship between $d'$ and the primary experimental effects, which constitute strong qualitative differences.

Unlike the pop/look paradigm, however, in the current paradigm it was necessary to have the separate, direct objective detection threshold index. This is because the current experimental tasks were indirect, not direct, and hence it could not be definitively assumed that conscious perception would invariably produce unidirectional influences on these tasks. At the same time, however, the subliminal effects' form appears to differ from the supraliminal effects in various ways that further buttress inferences for different processes being involved (e.g., the supraliminal unidirectional effect, which was, moreover, forward only; the absence of any supraliminal bidirectional effects, exclusive or otherwise; and no individual difference mediation supraliminally). Moreover, it is striking that, even though indirect, the experimental tasks yielded exclusively bidirectional effects quite analogous in form to those we have found with direct tasks, suggesting that this pattern may extend (at least) to indirect tasks that also index voluntary choices, as direct tasks invariably do.

*Michael Snodgrass*

## QUESTIONS FOR THE FUTURE

The four careful and incisive commentaries and the thoughtful responses by the individual co-authors carry us forward to a number of questions:

- What are the theoretical implications of the findings that individual differences mediate unconscious priming effects but not the conscious priming effect?
- What are the theoretical implications of the finding that the unconscious effects we obtained are bidirectional, involving both inhibition and facilitation?
- What are the implications for our understanding of primary process: Is it a form of thought, a form of perception, or both?

### The role of individual differences in mediating unconscious effects

We incorporated measures of individual differences into the experiment because we had previously found, as Snodgrass described in his commentary, that they played a significant role in previous experiments conducted at the objective detection threshold.

The results of most interest are those involving self-rated anxiety. What should not be overlooked is that this measure was obtained when the subject was conscious and alert. Yet conscious ratings of anxiety did not mediate conscious supraliminal forward priming. However, this same rating mediated not only the unconscious forward priming effect, but, remarkably, the palindrome priming effect as well. In fact, a high conscious anxiety rating and low stimulus detectability were correlated with *greater* forward and palindrome priming, while less conscious anxiety and

higher stimulus detectability were correlated with *less* overall priming.

It thus seems to be the case that a conscious process or state influences the direction of an unconscious effect. Moreover, there can be no conscious awareness of this interaction, insofar as the priming effects themselves are unconscious. In the terms of the controlled/automatic dichotomy (Shiffrin & Sneider, 1977), a controlled process (conscious self-rated anxiety) interacts with an automatic process (unconscious forward and palindrome priming) and mediates its effects. But according to the controlled/automatic theory, controlled processes are only supposed to affect other conscious processes and thus should have mediated the conscious forward priming effect. It didn't. And automatic unconscious processes are automatic because they are not under conscious control, but again our results indicated otherwise. The controlled/automatic theory attempting to explain the relationships between conscious and unconscious processes cannot account for our findings. Some other model is called for.

## The importance of bidirectional findings

In his response to Erdelyi's commentary, Snodgrass presents the argument on methodological grounds that the bidirectional effects are unconscious and cannot be explained on a conscious basis. Something different happens at the objective detection threshold. What must be true of unconscious processes for this to happen? The below-zero effects strongly imply that inhibitions are at work. Interestingly there are two kinds of inhibition present: inhibition of stimulus detection and inhibition of the priming effects. Inhibition of stimulus detection implies that the stimuli are being detected but then inhibited. Inhibition of the priming effects implies that the priming effects are being kept from occurring. In a psychodynamic framework, inhibition implies the operation of defenses, and defenses in turn imply conflict. Furthermore, psychodynamic theory provides a role for anxiety. In our study, high anxious subjects who inhibit detection of the stimuli are the very ones who show the forward and palindrome priming effects best. It would seem that the initial detection of the stimuli, while resulting in an effort to inhibit their further detection, nevertheless succeeds in activating conflict and anxiety. Their efforts to defend against whatever conflict has been activated by the experiment itself and/or the stimuli themselves has not been successfully defended against, resulting in higher anxiety and a regression toward primary-process mentation. The experiment only allows us to measure the latter. In support of this interpretation we have found in another study that conscious anxiety reported by patients waiting to see their doctors results in a regression to primary-process mentation (Brakel & Shevrin, 2005). On the other hand, low conscious anxiety suggests that the unconscious conflict has been adequately dealt with and therefore there is an inhibition of regression to primary-process mentation, and no need to inhibit stimulus detection. The need for inhibition suggests that primary-process mentation is modal at the objective detection threshold and would tend to dominate mental processes unless inhibited.

This account also helps us understand why main effects are not found at the objective detection threshold: Stimuli registered at that level are more likely to engage dynamic processes involving conflict, defenses, and anxiety that are inherently linked to individual personality and experience. At the supraliminal level, stimuli are dealt with largely in terms of their cognitive character.

## Primary process: a mode of thought, or perception, or both?

Our main finding can be stated simply: When the prime DOG is flashed at the objective detection threshold and is followed by a 3-sec exposure of the word ANGEL and a control word, more often than not ANGEL will be preferred, especially by those who are high in self-rated anxiety and low in prime stimulus detectability. What must happen unconsciously for ANGEL to be chosen? Our study starts with the supposition that unconsciously the word presentation is separated from the word meaning. This must happen if DOG is to be perceived as GOD. But in order to activate a choice of ANGEL, the word GOD must also be thought of as possessing word meaning. Does the primary process encompass both steps? If this is the case, then a secondary-process function, word meaning, appears paradoxically to enter into the primary process. Or does the primary process only apply to the first perceptual step? If so, then at the objective detection threshold, secondary-process effects are possible. Bazan, in her commentary, offers a third alternative: Primary-process effects can apply to word meaning as well as word presentation as long as the words are treated as isolated from any context so there is no constraint on what associative meanings they can activate. On the other hand, secondary processes operate to inhibit both phonemic and meaning-related associations that are not

germane to a particular context, thus disambiguating word meaning and treating the word as embedded in a specific context (e.g., a sentence). It is not word meaning as such but word-meaning-defined-by-context that is the mark of the secondary process.

Our account reinstates the importance of the connectionist conception of "spreading activation" as the mark of "automatic processes". Within Freudian metapsychology there is the analogous conception of "unbound cathexis," which is supposed to characterize the primary processes, while "bound cathexis" characterizes the secondary process. A sentence would be an example of "bound cathexis"; a stream of free associations, an example of "unbound cathexis." However, unlike the connectionist account, bound and unbound cathexes are tied closely to the status of motivation and defensive success. The more instinctual and drive-like the motivation, the more likely it is to mediate "spreading activation" or "unbound cathexes." The more defenses fail and the greater the anxiety, the more "unbound cathexes" will prevail.

The tentative answer to our question is to say that primary processes can operate at the level of perception as well as at the level of thought represented by word meaning. It is, rather, the nature of their activation that is critical. Future research will be required to explore this avenue of explanation, research in which motivation at different levels of intensity will need to be incorporated, as well as levels of anxiety and also responses such as free associations and sentence completions.

The authors of the study wish to express our thanks to our four commentators for their welcome reception of our findings and their perceptive assessment of them, from which we have learned a great deal.

*Howard Shevrin*

**REFERENCES**

Bachmann, T. (2004). Inaptitude of the signal detection theory, useful vexation from the microgenetic view, and inevitability of neurobiological signatures in understanding perceptual (un)awareness. *Consciousness and Cognition*, 13: 101–106.

Barnhardt, T. M. (2004). Different involuntary mechanisms underlie priming and LOP effects in stem completion tests. *Memory*, 12: 614–636.

Bazan, A. (in press). From sensory-motor control to psychoanalytical theories of action and language. *Attention and Performance, XXII*. Cambridge, MA: MIT Press.

Bazan, A., Brakel, L. A. W., Winer, E. S., Kushwaha, R., Snodgrass, M., & Shevrin, H. (in preparation). ERP markers for subliminal linguistic categorization.

Brakel, L. A. W. (2004). The psychoanalytic assumption of the primary process: Extrapsychoanalytic evidence and findings. *Journal of the American Psychoanalytic Association*, 52 (4): 1131–1161.

Brakel, L. A. W., Kleinsorge, S., Snodgrass, M., & Shevrin, H. (2000). The primary process and the unconscious: Experimental evidence supporting two psychoanalytic presuppositions. *International Journal of Psychoanalysis*, 81: 553–569.

Brakel, L. A. W., & Shevrin, H. (2005). Anxiety, attributional thinking, and primary process. *International Journal of Psychoanalysis*, 86: 1679–1693.

Brakel, L. A. W., Shevrin, H., & Villa, K. K. (2002). The priority of primary process categorizing: Experimental evidence supporting a psychoanalytic developmental hypothesis. *Journal of the American Psychoanalytic Association*, 50 (2): 483–505.

Burgess, C., & Simpson, G. B. (1988). Cerebral hemispheric mechanisms in the retrieval of ambiguous word meanings. *Brain and Language*, 33: 86–103.

Camaj, S., Snodgrass, M., Shevrin, H., & Brakel, L. A. W. (in preparation). "Synograms at the Objective Detection Threshold."

Caramazza, A. (1996). The brain's dictionary. *Nature*, 380: 485–486.

Caroll, J. (1956). *Language, Thought, and Reality: Selected Writings of Benjamin Lee Whorf*. Cambridge, MA: MIT Press.

Chee, M. W. L., Sriram, N., Soon, C. S., & Lee, K. M. (2000). Dorsolateral prefrontal cortex and the implicit association of concepts and attributes. *NeuroReport*, 11: 135–140.

Erdelyi, M. (2004a). Subliminal perception and its cognates: Theory, indeterminacy, and time. *Consciousness and Cognition, 13*: 73–91.

Erdelyi, M. (2004b). Comments on commentaries: Kihlstrom, Bachmann, Reingold, and Snodgrass. *Consciousness and Cognition*, 13: 430–433.

Gernsbacher, M. A., & Robertson, R. R. W. (1995). Reading skill and suppression revisited. *Psychological Science, 6*: 165–169.

Gorfein, D. S., Berger, S., & Bubka, A. (2000). The selection of homograph meaning: Word association when context changes. *Memory and Cognition*, 28: 766–773.

Haase, S., & Fisk, G. (2001). Confidence in word detection predicts word identification: Implications for an unconscious perception paradigm. *American Journal of Psychology*, 114: 439–468.

Haase, S., Theios, J., & Jenison, R. (1999). A signal detection theory analysis of an unconscious perception effect. *Perception & Psychophysics*, 61: 986–992.

Katz, S. (2001). Bidirectional experimental effects. *Psychological Methods*, 6: 270–281.

Kihlstrom, J. (2004). Availability, accessibility, and subliminal perception. *Consciousness and Cognition*, 13: 92–100.

Lacan, J. (1968). *The Language of the Self: The Function of Language in Psychoanalysis*. London: Johns Hopkins University Press.

Lakoff, G. (1997). How unconscious metaphorical thought shapes dreams. In: *Cognitive Science and the Unconscious*,

ed. D. Stein. Washington, DC: American Psychiatric Press, pp. 89–120.

Macmillan, N., & Creelman, C. (1991). *Detection Theory: A User's Guide*. New York: Cambridge University Press.

Marslen-Wilson, W. D. (1990). Activation, competition and frequency in lexical access. In: *Cognitive Models of Speech Processing: Psycholinguistic and Computational Perspectives*, ed. G. T. M. Altmann. Cambridge, MA: MIT Press, pp. 148–171.

Merikle, P., Joordens, S., & Stolz, J. (1995). Measuring the relative magnitude of unconscious influences. *Consciousness and Cognition*, 4: 422–439.

Muller, J. P., & Richardson, W. J. (1982). *Language and Lacan: A Reader's Guide to Écrits*. New York: International Universities Press.

Onifer, W., & Swinney, D. (1981). Accessing lexical ambiguities during sentence comprehension: Effects of frequency, meaning, and contextual bias. *Memory & Cognition*, 9: 225–236.

Papathanassiou, D., Etard, O., Mellet, E., Zago, L., Mazoyer, B., & Tzourio-Mazoyer, N. (2000). A common language network for comprehension and production: A contribution to the definition of language epicenters with PET. *NeuroImage*, 11 (4): 347–357.

Patten, C. V., & Kutas, M. (1988). Tracking the time course of meaning activation. In: *Lexical Ambiguity Resolution: Perspectives from Psycholinguistics, Neuropsychology, and Artificial Intelligence*, ed. S. L. Small. San Mateo, CA: Morgan Kaufman, pp. 289–310.

Poldrack, R. A., Wagner, A. D., Prull, M. W., Desmond, J. E., Glover, G. H., & Gabrieli, J. D. (1999). Functional specialization for semantic and phonological processing in the left inferior prefrontal cortex. *NeuroImage*, 10: 15–35.

Prather, P. A., & Swinney, D. A. (1988). Lexical processing and ambiguity resolution: An autonomous process in an interactive box. In: *Lexical Ambiguity Resolution: Perspectives from Psycholinguistics, Neuropsychology, and Artificial Intelligence*, ed. S. L. Small. San Mateo, CA: Morgan Kaufman, pp. 289–310.

Ragland-Sullivan, E., & Bracher, M. (1991). *Lacan and the Subject of Language*. New York: Routledge.

Rapp, B., Folk, J. R., & Tainturier, M. (2001). Word reading. In: *The Handbook of Cognitive Neuropsychology: What Deficits Reveal About the Human Mind*, ed. B. Rapp. Ann Arbor, MI: Edward Brothers, pp. 233–254.

Shevrin, H. (1973). Brain wave correlates of subliminal stimulation, unconscious attention, primary- and secondary-process thinking, and repressiveness. *Psychological Issues*, 8 (2): 56–87.

Shevrin, H., & Fisher, C. (1967). Changes in the effects of a waking subliminal stimulus as a function of dreaming and nondreaming sleep. *Journal of Abnormal Psychology*, 72: 362–368.

Shevrin, H., & Fritzler D (1968). Visual evoked response correlates of unconscious mental processes. *Science*, 161: 295–298.

Shevrin, H., & Luborsky L (1961). The rebus technique: A method for studying primary-process transformations of briefly exposed pictures. *Journal of Nervous & Mental Disease*, 133: 479–488.

Shiffrin, R. M., & Schneider, W. (1977). Controlled and automatic human information processing: II. Perceptual learning, automatic attending, and a general theory. *Psychological Review*, 84: 127–190.

Simpson, G. B., & Kang, H. (1994). Inhibitory processes in the recognition of homograph meanings. In: *Inhibitory Processes in Attention, Memory, and Language*, ed. D. Dagenbach & T. H. Carr. San Diego, CA: Academic Press, pp. 359–381.

Snodgrass, M. (2002). Disambiguating conscious and unconscious influences: Do exclusion paradigms demonstrate unconscious perception? *American Journal of Psychology*, 115: 545–580.

Snodgrass, M. (2004). The dissociation paradigm and its discontents: How can unconscious perception or memory be inferred? *Consciousness and Cognition*, 13: 107–116.

Snodgrass, M., & Shevrin, H. (2006). Unconscious inhibition and facilitation at the objective detection threshold: Replicable and qualitatively different unconscious perceptual effects. *Cognition*, 101: 43–79.

Swinney, D. A. (1979). Lexical access during sentence comprehension: (Re)consideration of context effects. *Journal of Verbal Learning & Verbal Behavior*, 18 (6): 645–659.

Tomasello, M. (2001). Perceiving intentions and learning words in the second year of life. In: *Language Development: The Essential Readings*, ed. M. Tomasello & E. Bates. New York: Blackwell, pp. 111–128.

Visser, T., & Merikle, P. (1999). Conscious and unconscious processes: The effects of motivation. *Consciousness and Cognition*, 8: 94–113.