

4

The Power of the Subliminal: On Subliminal Persuasion and Other Potential Applications

Ap Dijksterhuis, Henk Aarts, and Pamela K. Smith

In a word, is not the subliminal self superior to the conscious self?

—Henri Poincaré

In the past century, a few hundred articles have been published about subliminal perception and applications such as subliminal persuasion (see Dixon, 1971, 1981). This number suggests a mature field of research, in which, as in any mature field, researchers agree on a number of well-documented findings and argue over more recent contributions. However, in the field of subliminal perception and persuasion, scientists agree that the field is controversial and argue over everything else. Despite numerous findings demonstrating effects of subliminal perception, some people still maintain that the phenomenon itself does not even exist. Holender (1986), for instance, drew the conclusion that subliminal perception had never been reliably demonstrated, which led Dixon (who reviewed the field twice in 1971 and 1981) to comment that

the most interesting phenomenon to which Holender's paper draws attention is the extraordinary antipathy some people still have towards the idea that we might be influenced by things of which we are unaware. Would it be putting it too strongly to say it reminds one of the skepticism of "flat earth theorists" when confronted with the alarming theory that the world is round? (Dixon, 1986, p. 30; see also Merikle & Reingold, 1992)

The empirical study of subliminal perception started over a hundred years ago.¹ Peirce and Jastrow (1884) showed that participants (actually Peirce and Jastrow themselves) could discriminate between two objects on the basis

of their weights even when the difference in weight was so small that it could not be detected consciously. After choosing between objects, they indicated their confidence on a scale from 0 to 3, with a higher score representing more confidence. On almost all trials, they chose zero. However, they chose the correct object on more than 60% of the occasions. Although the minor differences in weight may have escaped consciousness, unconscious processes dealt with them with reasonable accuracy. In addition, they obtained comparable data with pressures that differed slightly in intensity and surfaces that differed slightly in brightness.

Other pioneering work was done by Sidis (1898; described in Merikle & Reingold, 1992, p. 58) and by Pözl (1917/1960). In Sidis's work, subjects were shown cards containing a single digit or letter, but these cards were so far away that the subject "saw nothing but a dim, blurred spot or dot" (Sidis, 1898, p. 170). In fact, "the subjects often complained that they could not see anything at all; that even the black, blurred, dim spot often disappeared from their field of vision" (p. 171). However, when Sidis asked the subjects to name the character on the card, their responses were correct more often than would be expected on the basis of pure random guessing, even though many subjects stated "that they might as well shut their eyes and guess" (p. 171).

Finally, Pözl (1917/1960) investigated the consequences of subliminal perception on imagery during dreams. He showed participants various pictures for very short durations (10 ms) and predicted that although these pictures could not reach conscious awareness, they would remain active subconsciously long enough to be able to present themselves in dreams. According to Pözl, some of the images recurred in the dreams of the experimental participants.

In the first half of the twentieth century, others replicated and extended the aforementioned early studies (see Adams, 1957, for a review). On the basis of these findings, one may be excused for not grasping why the study of subliminal perception is so controversial. After all, the field appears to have had a promising start. When a few people report interesting results and when a few others replicate and extend these results, one would normally conclude that a healthy new field has been born.

In our view, there are two (interacting) reasons for the unusual development of the field of subliminal perception. First of all, the idea that our behavior—or our functioning in general—is driven by unconscious perception makes many people uncomfortable. As Nørretranders (1998, p. 158) pointed out, "the notion that human behavior can be influenced by perceptions which do not lead to consciousness but merely remain in the organism has always been associated with considerable fear." The second reason is James Vicary and the notion of subliminal persuasion. Subliminal persuasion refers to the subliminal presentation of stimuli by people (e.g., advertisers) who intentionally try to influence our behavior. Vicary claimed in 1957 that he

increased the sales of popcorn and cola after subliminally flashing "Eat Popcorn" and "Drink Coke" in a New Jersey cinema. This caused a stir both inside and outside the scientific community. A few years later, Vicary admitted that his (nonreliable) results did not warrant strong conclusions and that there was no evidence at all for subliminal persuasion, but the damage had already been done. The number of researchers seriously working on the topic decreased dramatically for at least the next 20 years. Moreover, the few experimental psychologists that did publish on subliminal phenomena were far from supportive. Some indicated that the chance that subliminal persuasion could ever work was extremely remote (Moore, 1982) or worse, that the whole idea was just a myth and that we should stop investigating it altogether (Pratkanis, 1992; see also Packard, 1978).

But is it a myth? Should we stop? In this chapter, we argue that we should not stop and that subliminal persuasion and other applications of subliminal stimulation should be investigated, not ignored. The remainder of this chapter is divided into four parts. First, we discuss our definition of subliminal perception. We also present arguments for why it is impossible, or at least difficult, to maintain that all (important) behavior should be the result of conscious thought. In the second part, examples of basic effects of subliminal stimulation are used to demonstrate what subliminal stimulation can do. Third, a crude theoretical basis for the effects of subliminal persuasion and other applications is provided, relying largely on social cognition research. In the fourth and most important part, we discuss research relevant for the practical, commercial, or political use of subliminal stimulation. A distinction is made between (a) the manipulation of attitudes by subliminal evaluative conditioning, (b) the influence of subliminal messages on consumer behavior, and (c) the influence of subliminal messages on health. With these empirical results, we hope to show that applications of subliminal stimulation are worthy of space on the scientific agenda. In our concluding section, we discuss three arguments in favor of the study of subliminal perception.

Definition Issues

A Note on Thresholds

Both the content and the tone of many publications on subliminal phenomena have been affected by the fear and antipathy they elicit. One example, important for the present purposes, is the effort to define subliminal perception out of existence (Eriksen, 1960; Holender, 1986).

The definition of subliminal perception was a topic of hot debate in the mid-1980s (Cheesman & Merikle, 1984, 1986; Fowler, 1986; Holender, 1986; Wolford, 1986; see also Kihlstrom, Barnhardt, & Tataryn, 1992). The

discussion was based on the concepts of objective and subjective thresholds (e.g., Cheesman & Merikle, 1984). An objective threshold has to be passed for a stimulus to be sensed, that is, to enter the appropriate sensory system. A subjective threshold is one that has to be passed for a stimulus to enter conscious awareness. If the objective threshold is not passed, perception does not occur. If the objective threshold is passed but the subjective is not, subliminal perception occurs. If the subjective is passed as well, conscious perception occurs.

Holender (1986) argued that researchers could not rely on the subjective threshold as a measure of conscious perception. Instead, Holender said that only an objective threshold could be a dependable defining criterion. He argued that when there is some demonstrable sensory effect of a stimulus—that is, if the objective threshold is reached—it can never be guaranteed that people did not also become conscious of the stimulus. Imagine sitting in front of a computer screen on which a word is briefly shown. It goes so fast that you only see a flash. You do not know which word it was. According to Holender, if you cannot verbally report a stimulus, this does not necessarily mean that it did not reach consciousness. Maybe it reached consciousness half a second ago and you forgot. It should be clear that this sole reliance on the objective threshold proposed by Holender “effectively rules the phenomenon of subliminal perception out of existence,” as noted by Kihlstrom and colleagues (1992, p. 20).

Most researchers disagreed with Holender (1986). He imposed a criterion that ignores an essential aspect of consciousness: awareness. A definition of consciousness must appeal to the notion of awareness, not just to some psychophysiological definition of detection. As Paap (1986, p. 45) in his comment on Holender noted, “it simply does not make sense to say that the thermostat in my house is conscious of New Mexico’s hot days and cool evenings.” Nørretranders (1998; see also Jaynes, 1976; Libet, 1985) argued convincingly that consciousness should be treated as a primary phenomenon. What is in consciousness is in consciousness; what is not is not. If one wants to know what is in consciousness, one should ask consciousness itself. Or, as Nørretranders (1998, p. 226) puts it, “consciousness is a primary phenomenon, which the experimenter has no right to argue with.”

So subliminal perception is perception that passes the objective threshold (i.e., it is discriminated by the senses) but fails to pass the subjective threshold (i.e., it fails to reach conscious awareness and cannot be reported verbally). But can we determine this subjective threshold? Not really, or at least not in an absolute sense. There is no fixed subjective threshold that works for all people under all circumstances. The idea of a fixed threshold has been superseded as a consequence of insights from signal detection theory (see e.g., Greenwald, Draine, & Abrams, 1996). Whether a briefly presented stimulus does reach conscious awareness or not depends on stable individual differences, on current goals and needs, and on various contextual effects.

Some have argued that as there is no such thing as a fixed subjective threshold, we should abandon the term *subliminal* (*limen* means threshold in Latin) altogether (e.g., Kihlstrom et al., 1992), and instead use terms such as *implicit* or *unconscious perception* instead. We chose to use *subliminal* because it is the term most often used to describe these phenomena (see also Greenwald et al., 1996). Implicit or unconscious perception refers to perception that does not reach conscious awareness, but these terms do not distinguish between the various reasons why the information did not enter consciousness. A perceived stimulus may not enter consciousness because it is presented very briefly. However, a perceived stimulus also may not enter consciousness because little attention is paid to it; with a bit more attention the stimulus could have entered consciousness. For instance, while driving a car people "see" many billboards, although the information on these billboards never reaches conscious awareness, simply because people do not pay attention to them. With more attention, the information on the billboards would enter consciousness. This is implicit perception or unconscious perception. However, subliminal perception is generally used to refer to stimuli that are presented in such a way that they cannot reach conscious awareness, even if attention is directed to them. This, then, is also the definition we adopt for this chapter.²

Do We Really Want Consciousness to Be in Charge?

Researchers who investigate subliminal perception (or even unconscious psychology in general) have always met with some resistance. Many people simply want to believe that subliminal perception does not exist. Others, forced to admit there is something to it after hearing about one or more convincing demonstrations, downplay its importance. This is rooted in the fear that "we" (our consciousness) are not in control of our behavior, and in the belief that conscious thought should mediate everything we do, at least when our behavior and the decisions we make become more important. But should we really hold onto that belief? Do we really always want conscious thought to produce, or at least mediate, our behavior?

First of all, and strictly speaking, conscious thought does not exist. Thought, when defined as producing meaningful associative constructions, happens unconsciously (Jaynes, 1976). One may be aware of some of the elements of a thought process or one may be aware of a product of a thought process, but one is not aware of thought itself. Watt (1905; see also Jaynes, 1976; Nisbett & Wilson, 1977) demonstrated the inaccessibility of thought to consciousness. In his experiment, participants were presented with nouns (e.g., oak) and were asked to come up with a particular association as quickly as they could. Sometimes, participants were required to associate the noun with

a superordinate word (oak-tree), while on other occasions they were to name a part (oak-acorn) or a subordinate (oak-beam). The idea was that conscious thinking could be divided into four stages: the instructions (e.g., superordinate), the presentation of the noun (e.g., oak), the search for an appropriate association, and the uttered reply (e.g., tree). Participants were asked to introspect on all four stages separately, to assess the contribution of consciousness during each stage. Of course, the third stage (searching for an association) is the stage during which the actual thinking takes place and hence, it is during this stage that one would have expected conscious thought. This stage, however, was introspectively blank: participants could not report anything. The instruction in combination with the presentation of the noun automatically started the thinking process. And this thinking occurred outside of conscious awareness. Importantly, this is true for all thought, not just an elementary experiment on word association, and for important creative processes as well. Thinking about an article we want to write is an unconscious affair. We read and talk, but only to acquire the necessary materials for our unconscious mechanisms to chew on. We are consciously aware of some of the products of thought that sometimes intrude into consciousness ("I have to use the article by Watt to get this message across!"), but not of the thinking—or chewing—itself.

Frankly, we think we should be happy that thought is unconscious. Nørretranders (1998) summarizes results from the 1950s and 1960s, when a number of people were interested in human processing capacity. Their research was devoted to the processing capacity of consciousness and of the senses. The processing capacity of the senses can be seen as our total processing capacity. In order to compare different forms of information (e.g., tactile versus visual versus auditory), information was measured in bits. As it turned out, our senses can handle about 11 million bits per second (Zimmermann, 1989; see Nørretranders, 1998, for a detailed analysis). This whopping number is largely the result of our sophisticated visual system, which can handle about 10 million bits per second. The processing capacity of consciousness pales in comparison. The exact number of bits consciousness can process depends on the task. When we read silently, we process about a maximum of 45 bits per second (a few words); when we read aloud, it drops to 30. When we calculate (e.g., when we multiply two numbers), we can handle only 12 bits per second. Compared to our total capacity, these numbers are incredibly small. If we conclude that our consciousness can process 50 bits per second (which is optimistic; see Küpfmüller, 1962; Nørretranders, 1998), our total capacity is 200,000 times as high as the capacity of consciousness. In other words, consciousness can only deal with a very small percentage of all incoming information. All the rest is processed without awareness. Let's be grateful that unconscious mechanisms help out whenever there is a real job to be done, such as thinking.

The enormous processing capacity of the unconscious is very important. One of the authors of this chapter recently bought an apartment. Between the moment he first entered the building to explore it and the moment he made a bid, all of about 10 minutes passed (it was a two-bedroom apartment, so exploring it didn't take long). Intuitively, one may say that this is a very poor way of deciding. Granted, if the decision to buy this apartment was based solely on conscious processes, it would have been very poor indeed. Consciousness cannot accomplish much within 10 minutes, as we have seen. However, the decision was based on a sense that "this place just feels very good; let's do it" (and obviously on a few things that were known beforehand, such as the location of the building and the quality of its foundations). Many people take days or weeks to decide to buy a home, but the real decision is often made in a matter of minutes. The remaining time is used to make such an important decision feel less scary and maybe to rule out a few potential risks. The reason we can make such a decision fast is that within 10 minutes, unconscious perception and unconscious thought can process (about) 6.6 billion bits. This sense of "it feels good; let's do it" (see also Damasio, 1994), then, could well be based on an enormous amount of information. One could defend that from a normative perspective (more than 6 billion bits!), it isn't a poor way of deciding.³

Do we really want to depend primarily on consciousness? We should appreciate unconscious perception. Without it, we would not be able to accomplish much at all. If we assume, on the basis of the previous paragraph, that it takes the processing of roughly 6.6 billion bits to decide to buy a house, consciousness alone would need 4 years to make such a decision.

Importantly, if we accept that unconscious perceptual processes have a paramount influence on human functioning, then we also should accept that subliminal perception may have far-reaching consequences. We cannot agree that many things are perceived and processed unconsciously and at the same time rule out the possibility that subliminal exposure to stimuli can affect us.

The Strings We Can Pull

As alluded to above, for many years the question of whether subliminal perception did exist was a topic of hot debate. More recently, however, evidence for subliminal perception has accumulated. As a result, the controversy has shifted more and more toward the question of what exactly can be elicited by exposure to subliminal stimuli. Does subliminal perception only have relatively "innocent" and brief semantic effects, or can it affect more important matters such as our emotional life or our overt behavior? In concrete terms, if we subliminally flash the word *steak*, what are the consequences? Does it prime the associated word *cow*? Does it cause changes in affect so that vege-

tarians have a strong negative reaction and hungry nonvegetarians have a strong positive reaction? Does it affect behavior? Are we getting hungry? In sum, exactly which strings can we pull subliminally?

In this section, we point at some evidence of the known consequences of subliminal stimulation. For now, we restrict ourselves to effects on nonapplied domains, and we discuss one or two examples from each domain. We differentiate between (a) neurological correlates, (b) evaluative and affective effects, (c) semantic effects, (d) effects on social judgments, and (e) effects on overt behavior.

Neurological Correlates

Libet, Alberts, Wright, and Feinstein (1967) were presumably the first to provide physiological evidence for subliminal perception. In their experiments, they stimulated the skin of their participants so subtly participants could not consciously report it. Concurrently measured evoked potentials, however, showed changes in the electrical field around the brain. Although their measurements were crude, they did provide unequivocal evidence for brain activity as a result of perception that escaped conscious awareness. Later, Dehaene et al. (1998) and Whalen et al. (1998) also reported evidence of neurological effects of subliminal stimulation.

Evaluative and Affective Effects

In 1968, Zajonc launched the idea of mere exposure: the more we are exposed to a stimulus, the more we like it. Kunst-Wilson and Zajonc (1980) first demonstrated that even subliminal exposure to a stimulus enhances one's attitude toward this stimulus. In their experiment, participants were presented with 10 polygons, each five times for only 1 ms. Afterward, participants were presented with pairs of polygons, consisting of an "old" (e.g., previously presented) and a "new" polygon. For each pair, participants had to indicate which one they thought was previously presented to them and which one they liked most. Participants more often preferred the previously presented polygon to the new one, without being able to say which polygon had been presented. This subliminal mere exposure effect has been replicated a number of times since (see Bornstein, 1992, for a review).⁴

Basic Semantic Effects

Debner and Jacoby (1994) obtained evidence for semantic subliminal processing with a particularly convincing paradigm. In their experiments, they presented five-letter words (e.g., *scalp*) on the computer screen subliminally. After

a word had appeared, participants were presented with a word stem with three letters of a word (e.g., *sca-*). Participants were requested to generate a five-letter word to complete the presented word stem. In some conditions, participants were urged not to choose the word that had just been presented. Relative to a control condition in which the same word stem was presented without earlier exposure to an applicable subliminal word, people who were asked not to use the subliminally presented word used it more often. With this task, evidence was obtained for the semantic processing of a word while at the same time ensuring that this word was not consciously perceived (see also Marcel, 1983; Merikle, Joordens, & Stolz, 1995).

Social Judgments

Bargh and Pietromonaco (1982) showed that subliminally activated trait constructs affect the impression we form of others. Participants in their experiments were presented with flashes (actually words) on different locations on the screen and were asked to identify the location of each flash. Depending on the experimental condition, either 0%, 20%, or 80% of the words were associated with the trait construct of hostility. After completing this task, participants were presented with a brief description of a stimulus person who behaved in an ambiguously hostile way. The impression participants formed of this stimulus person was influenced by their subliminal exposure to the words: the more hostile words presented earlier, the more negative the impression of the stimulus person became. Importantly, recognition memory for the flashed words did not exceed chance level. In later work, these findings were replicated for subliminally activated social stereotypes (Devine, 1989; Lepore & Brown, 1997).

Behavior

Research has demonstrated that activated trait constructs and social stereotypes not only affect judgments about others, but also affect participants' own overt behavior. Activated traits and stereotypes bring behavior in line with the particular trait or stereotype (Bargh, Chen, & Burrows, 1996; Dijksterhuis & van Knippenberg, 1998; see Dijksterhuis & Bargh, 2001, for a review). Bargh and colleagues (1996, Experiment 3) found enhanced hostility among participants for whom the stereotype of African Americans was activated subliminally. In their experiment, participants performed a very laborious computer task. During this task, some participants were subliminally presented with photographs of male African Americans while others were subliminally presented with photographs of White males. After participants had been performing the task for a while, the computer program beeped, an error message

appeared, and participants were told that they had to start all over again. The participants were videotaped during the experiment and the dependent variable was the level of hostility participants displayed upon hearing that they had to redo the task. The experimenter (who was blind to conditions) and several independent coders rated the reaction of the participants primed with African American faces as more hostile than the reaction of the participants primed with White faces. Later, these effects were replicated and extended in other research (Chen & Bargh, 1997; Dijksterhuis, Aarts, Bargh, & van Knippenberg, 2000; Dijksterhuis & Corneille, 2001).

It should be clear from these many experiments that subliminal perception does much more than bring about small semantic effects. Subliminal perception can elicit affective responses, and it can influence both social judgments and overt behavior.

Mental Representations Are Crucial

Some may find the effects described in the previous section surprising. This surprise stems largely from the fact that these effects were elicited by subliminal stimulation. If effects such as the ones described above were the result of some form of a supraliminal (i.e., conscious) manipulation, they would be much less surprising. But is that justified?

The surprise is based on the implicit assumption that our brain makes a distinction between supraliminal and subliminal priming episodes. That is, it is based on the idea that our brain cares whether something is primed with conscious mediation or without conscious mediation. We would like to argue, however, that 99 out of 100 times the brain does not care at all whether something is primed subliminally or supraliminally. "We" (i.e., humans) do, as shown by the strong reactions evoked by the possibility of effects of subliminally presented stimuli on behavior, but our brains do not. If the mental representation of *hostile* or *woman* is activated, certain psychological consequences follow, irrespective of whether activation of the word was the result of subliminal or supraliminal perception. Therefore, if supraliminal activation of a stimulus has a particular effect, subliminal activation of the same stimulus should have the same effect (for similar reasoning, see Bargh, 1989, 1992). In sum, it is the activation of a mental representation that is crucial for launching other psychological processes. The way this representation was activated (subliminal versus supraliminal) is not important.

In the realm of social cognition, there is much support for the claim that activation of mental representations is crucial regardless of the way they were activated. A number of phenomena that were first demonstrated with supraliminal presentation techniques were later replicated with subliminal tech-

niques. Higgins, Rholes, and Jones (1977; see Srull & Wyer, 1979, 1980, for other early demonstrations) showed that supraliminal exposure to trait terms influences impressions we form of others. The previously discussed experiment by Bargh and Pietromonaco (1982) later demonstrated that this effect could be evoked by subliminal activation of a trait construct as well. Dovidio, Evans, and Tyler (1986) found that supraliminal activation of a social category ("elderly") led to enhanced accessibility of associated stereotypes ("slow" or "forgetful"). A few years later, Devine (1989) extended these effects by showing that subliminal category activation led to stereotype activation as well. After Fazio, Sanbonmatsu, Powell, and Kardes (1986) demonstrated that supraliminal words were automatically evaluated, Greenwald and colleagues (Greenwald, Klinger, & Liu, 1989; Greenwald, Klinger, & Shuh, 1995) obtained evidence for the automatic evaluation of subliminally presented stimuli. Bargh, Dijksterhuis, and colleagues (e.g., Bargh et al., 1996; Dijksterhuis & van Knippenberg, 1998; Dijksterhuis, Spears, et al., 1998; see Dijksterhuis & Bargh, 2001, for a review) found evidence that both subliminally and supraliminally activated traits and stereotypes affect overt behavior. They even compared supraliminal and subliminal activation while using the same stereotype and the same behavioral measure. Dijksterhuis, Bargh, and Miedema (2000) demonstrated that having participants answer questions about elderly people for a few minutes made participants forgetful, whereas Dijksterhuis, Aarts, et al. (2000) showed that subliminally flashing words related to the stereotype of the elderly reduced memory performance in the same way.

In all these cases, activation of a mental representation drove the effects, irrespective of whether this representation was activated supraliminally or subliminally. We concede, however, that there are a few exceptions in which awareness is crucial (see Bargh, 1992). Importantly, stimuli we are consciously aware of can elicit control strategies—often aimed at counteracting the influence of the stimulus—that will not be evoked when stimuli are perceived without awareness. What is critical in such cases is that people are aware of how a stimulus may influence their judgments or behavior. If people are not aware of such influence, or if people do not know how a stimulus might influence them, these control processes are not used (see Bargh, 1989, 1992). Still, under some conditions, conscious awareness of a stimulus does elicit processes aimed at controlling the influence of this stimulus. When "sensitive" material is activated—such as racial stereotypes—participants may be motivated to suppress the influence of the activated stereotypes (e.g., Monteith, Devine, & Sherman, 1998).

Notwithstanding a few diverging cases, we believe that in the vast majority of cases supraliminal exposure and subliminal exposure have the same effects. This, then, has important consequences for subliminal persuasion and other applications of subliminal presentation techniques.

Using and Abusing Subliminal Stimulation

In this section, we discuss applications of subliminal stimulation. Our aim is to give an objective account of the possibilities and impossibilities of intentionally influencing people's behavior with subliminal presentation techniques. Old evidence is discussed and some recent evidence is presented. Furthermore, based on our assumption that activation of mental representations is crucial (often) irrespective of the way they are activated, we occasionally extrapolate from findings obtained with supraliminal presentation techniques.

We differentiate between three different applications. First, people have attempted to change attitudes through evaluative conditioning techniques. Such methods have been used to change attitudes toward both people and objects. Second, rather than affecting behavior through changing their attitudes, people have tried to directly influence consumer behavior. Third, people have tried to design devices that convey subliminal messages aimed at affecting people's health.

Changing Attitudes

In September 2000, U.S. presidential candidate George W. Bush was accused of employing dubious campaigning techniques. One of the television ads Bush broadcast during his campaign used near-subliminal evaluative conditioning techniques. In this ad, the face of his Democratic opponent Al Gore appeared, while pieces of the words *bureaucrats* and *democrats* were flashed on the screen repeatedly. At one point, the face of Al Gore appeared on the screen, while simultaneously the word *RATS* was presented. The word appeared in the center of the screen, covering the entire screen, for one thirtieth of a second. Since it could be consciously detected by paying very close attention, presentation of the word was not subliminal (or, as Bush would have it, "subliminable" [Bruni, 2000]). Still, it was presented so briefly that it presumably escaped conscious detection among the vast majority of viewers.

For scientists, the interesting question is whether such a technique works. Can we pair a person with a subliminally presented (pretending that Bush's people had done a proper job) extremely negative word and change people's attitude toward this person? Can such a technique even influence actual voting behavior? Or can people's attitudes toward a product be enhanced by pairing presentation of this product with a subliminally presented positive stimulus? Will people actually buy it?

Razran (1940) was the first to use evaluative conditioning techniques to influence attitudes. He reasoned that by pairing presentation of an object (from now on referred to as CS, or its plural, CSi) with presentation of a negatively or positively valenced stimulus (US, USi), this object would eventu-

ally acquire the same negative or positive experienced valence. Razran's method was simultaneously crude and ecologically appealing. Participants were presented with slogans and had to indicate whether they agreed with each slogan or not. Some participants were presented with the statements while they enjoyed a free lunch, while others were presented with the slogans while inhaling unpleasant odors. When Razran measured agreement with the statements on a later occasion, participants agreed more with the statements if they were first presented during lunch than if they were first presented while participants inhaled the odors.

Later, Staats, Staats, and colleagues (Staats & Staats, 1957, 1958; Staats, Staats, & Crawford, 1962) investigated evaluative conditioning under more controlled circumstances. They paired words (sometimes nonsense words) with various valenced stimuli, ranging from positive or negative words to electric shocks or annoying sounds. Attitudes toward the words were consistently affected by their evaluative conditioning techniques: words paired with positive stimuli were rated as more positive, whereas words paired with negative stimuli were rated as more negative. Staats and Staats also proposed that the effect was not dependent on participants being consciously aware of the contingency between paired stimuli (CS-US).

But is that true? Though the phenomenon of evaluative conditioning itself has been demonstrated numerous times (see De Houwer, Thomas, & Baeyens, 2001, for a review), the question of contingency awareness is still a topic of debate. While most maintain that contingency awareness is not necessary (De Houwer, Hendrickx, & Baeyens, 1997; Hammerl & Grabitz, 1993; Krosnick, Betz, Jussim, & Lynn, 1992; Olson & Fazio, 2001), others are still not convinced (Davey, 1993; Field, 2000). For the present purposes, however, we can go one step further: Is it possible to demonstrate evaluative conditioning with subliminally presented positive or negative USi? If this is true, the contingency awareness question is solved, as one cannot be aware of a contingency between a CS and a US without being first aware of the existence of a US.

Indeed, there is evidence for subliminal evaluative conditioning. Krosnick and colleagues (1992) presented their participants with nine slides of a target person engaging in routine daily activities. These slides were preceded by slides of positive or negative events (e.g., a child with a Mickey Mouse doll versus a bloody shark) presented for 13 ms. Later, participants were asked to assess their evaluation of the target person. A target person paired with positive stimuli was evaluated more positively in general and was rated as having a nicer personality than a target person paired with negative stimuli. These findings were replicated in a second experiment. Other researchers have also found evidence for subliminal evaluative conditioning (De Houwer, Baeyens, & Eelen, 1994; De Houwer et al., 1997; Murphy, Monahan, & Zajonc, 1995; Murphy & Zajonc, 1993; Niedenthal, 1990).

In light of all the evidence, we may safely conclude that attitudes can be changed (or formed) by subliminal evaluative conditioning. This does not imply, of course, that commercial or political use of subliminal evaluative conditioning will have any success. Most potential applications of subliminal evaluative conditioning differ from published research in two ways. First, Al Gore, McDonald's, or Coca-Cola are stimuli people are already familiar with. Second, people already have existing positive or negative attitudes toward such stimuli. In other words, the stimuli of import for applied purposes are not neutral (at least not for the vast majority of people). While the role of familiarity has received some attention in past research, as far as we know prior attitudes have never been taken into account. In fact, most published research on evaluative conditioning has used only neutral stimuli as CSs. One may expect that people with neutral and/or weak attitudes are easier to influence than people with strong and/or extreme attitudes, but this matter awaits scrutiny.

The potential moderating role of familiarity has been investigated in the supraliminal evaluative conditioning domain. Shimp, Stuart, and Engle (1991; see also Stuart, Shimp, & Engle, 1987) used both well-known brands (Coca-Cola and Pepsi) and new brands in their evaluative conditioning research. In their experiments, they paired these brand names with pleasant and unpleasant pictures. The attitudinal effects of evaluative conditioning were more pronounced for unfamiliar than for familiar stimuli, but even attitudes toward familiar stimuli were influenced. Cacioppo, Marshall-Goodell, Tassinary, and Petty (1992) obtained similar findings, again with supraliminal evaluative conditioning. They presented people with both words (i.e., familiar stimuli) and nonwords (i.e., unfamiliar stimuli) paired with mild electric shocks. Whereas the attitudes toward nonwords were affected to a greater extent than attitudes toward words, attitudes toward words were affected as well. In sum, there is some converging evidence for the moderating effect of familiarity: attitudes toward familiar stimuli can be changed with evaluative conditioning, but attitude change is more pronounced when stimuli are novel.

For practical applications, important parameters of evaluative conditioning are the relation between frequency of CS-US pairing and the size of the effect, as well as the decay function of these effects. After all, advertisers need to know whether only couch potatoes who watch hours of television (and thus television advertisements) will be affected by their subliminal messages, and if these effects will dissipate before their viewers ever step inside a store (or into a voting booth). The Bush campaign showed their almost-subliminal ad about 4,000 times (Berke, 2000). Intuitively, it makes sense to opt for a high frequency of CS-US pairings, but this idea is only partly supported by research findings. Comparing conditions of 1, 3, 10, and 20 supraliminally presented pairings, Stuart and colleagues (1987) concluded that higher frequencies led to greater effects, but also that the effect of frequency was weak.

Finally, Baeyens and colleagues (Baeyens, Crombez, van den Bergh, & Eelen, 1988; Baeyens, Eelen, Crombez, & van den Bergh, 1992) also compared different frequencies of supraliminally presented CS-US pairings and found that up to at least 10 pairings, higher frequencies led to greater effects. Beyond this point, however, they suggest that there may actually be an inverse relation between frequency and effect size. In sum, one may—with some care—conclude that for low frequencies there seems to be a weak but positive relation between frequency and effect size, while the relation for higher frequencies is unclear at this point.

The relevant findings concerning the decay or extinction of evaluative conditioning effects are quite spectacular. Baeyens and colleagues (1988) supraliminally paired neutral faces with liked or disliked faces and showed that attitudes toward the neutral faces paired with liked pictures were more positive than attitudes toward neutral faces paired with disliked stimuli. Two months later, when participants evaluated the same conditioned pictures again, there was no sign of decay: the difference in liking between the neutral faces paired with liked pictures and the neutral faces paired with disliked pictures was still highly significant. Levey and Martin (1975) reported even more impressive findings: their effects of evaluative conditioning were still reliable after 18 months.

Can we conclude, on the basis of the current evidence, that subliminal evaluative conditioning can have effects when it is applied for political or commercial reasons? It is true that subliminal evaluative conditioning has been shown to work. It is also true that effects of evaluative conditioning do not decay quickly. Finally, both familiar and unfamiliar targets can be conditioned, although attitudes toward the latter are easier to manipulate. Hence, though we do not yet know whether prior attitudes (and the strength and extremity of these attitudes) moderate effects of evaluative conditioning, it is possible that advertisers or politicians could subliminally shape or change our attitudes toward a new toothpaste, McDonald's, or Al Gore.

An important disclaimer is that evaluative conditioning affects attitudes but not necessarily behavior. Someone may be able to subliminally influence our attitude toward a new toothpaste or even toward Al Gore, but that does not yet imply that they also affect what toothpaste we buy or which presidential candidate we vote for. The factors that influence the relation between attitudes and behavior are too numerous to discuss here, but some assumptions can be made regarding the relation between attitudes influenced by evaluative conditioning and actual behavior. Cacioppo and colleagues (1992) reasoned that attitudes based on evaluative conditioning could determine less rational and impulsive behavior, while they could not (or could hardly) affect more deliberate, intention-driven behavior. This idea is supported by other contributions in the attitude literature. Evaluative conditioning creates attitudes that can be activated automatically upon perception of the attitude

object (Olson & Fazio, 2001). According to Fazio's (1990; see also Fazio et al., 1986) MODE model, attitudes that are automatically activated upon perception of the attitude object affect overt behavior in the absence of more motivated and elaborate issue-relevant thinking and have far smaller effects when people engage in significant deliberation. Roughly speaking, the more we think about a behavior, the less influence prior evaluative conditioning should have on this behavior. Hence, with subliminal evaluative conditioning it may well be possible to exert some influence over the toothpaste people buy. However, it is likely to be much harder to influence a house purchase, at least for people who deliberate about such things. As for a decision such as a vote for a presidential candidate, it seems highly doubtful that evaluative conditioning could exert much influence. Given the current evidence, though, it is premature to give definite answers or to rule out any possibilities.

Changing Consumer Behavior

The single most controversial area within the domain of subliminal psychological processes is "subliminal persuasion": the direct influence of consumer behavior by subliminal directives. As alluded to before, this idea can be traced to a newspaper publication about James Vicary, who claimed that he had greatly increased the sales of popcorn and cola in a New Jersey cinema by subliminally flashing "Eat Popcorn" and "Drink Coke" during a movie. This newspaper article caused a tremendous stir: Moore (1982), who published a very insightful review of the area, quotes *The Nation* as stating that it is "the most alarming and outrageous discovery since Mr. Gatling invented his gun" (p. 206). Although Vicary later admitted he never found any evidence for subliminally influencing behavior, the majority of people outside academia believe in the potential power of subliminal messages. This is partly because Vicary's original claim was noticed by many, while his later "erratum" was noted by very few (Pratkanis, 1992). Another reason for this belief's persistence is that people have made grandiose yet largely unsubstantiated claims about both the effectiveness and pervasiveness of subliminal persuasion (e.g., Key, 1989), whereas the skeptics have published their work in scientific articles that are obviously less accessible to people outside the scientific community. Still, many people believe in the power of subliminal persuasion: Rogers and Smith (1993) found that 75% of Americans had heard of subliminal persuasion and of these 75%, another 75% believed it worked (see Zanot, Pincus, & Lamp, 1983, for comparable figures).

Can we, on the basis of the current scientific evidence, draw any conclusions regarding the effectiveness of subliminal persuasion techniques? Despite quite a number of publications, this is surprisingly difficult. To explain why the popular belief in subliminal persuasion is strong, Pratkanis (1992) char-

acterized the study of subliminal persuasion as a form of "cargo cult" science (see Feynman, 1985). A cargo cult science "has all the trappings of science—the illusion of objectivity, the appearance of careful study, and the motions of an experiment—but lacks one important ingredient: skepticism" (Pratkanis, 1992, p. 264). This is without doubt true: Many claims have been made on the basis of the flimsiest of evidence (e.g., Key, 1989). However, to objectively assess whether subliminal persuasion can work, one has to deal with a second problem: the science devoted to showing that subliminal persuasion does not work can just as well be characterized as a cargo cult science. Because many scientists simply do not want subliminal persuasion to work, rather unusual practices can be witnessed in the literature. It may be the only area in psychology where greater value and credibility are attached to null results than to actual significant results, and where it is so easy to publish noneffects. Furthermore, effects that are obtained are often downplayed by the authors themselves because they did not want to find them (e.g., Trappey, 1996). In addition, scientists often advise their colleagues not to investigate the topic (see, e.g., Packard, 1978; Pratkanis, 1992) and many have used rather extreme and often suggestive language in their publications (see also the first paragraph of this chapter). Pratkanis (1992) said, "Of course, as with anything scientific, it may be that someday, somehow, someone will develop a subliminal technique that may work, just as someday a chemist may find a way to transmute lead into gold" (p. 269).

But let us return to the important question. Can it work? Should we buy lead futures? If we want to assess whether subliminal persuasion could ever work, it may be useful to differentiate between three distinct psychological processes that may be influenced. First, can we make people hungry or thirsty by subliminal messages? That is, can we alter people's basic physiological needs or the subjective experience of these needs? Second, can we change people's behavior itself? Can we make them drink or eat more? Finally, can we affect people's choices? Given that people want to drink, can we get them to choose one brand over another through subliminal messages? We discuss these issues in three sections.

Thirst and Hunger One way to subliminally influence people's behavior is to make them hungry or thirsty. Byrne (1959) was the first to test this idea. In his experiment, he flashed the word *beef* repeatedly (140 times) during a 16-minute movie. Importantly, Byrne (1959) ensured that people were not aware of the subliminally presented word. Compared to a control group, subliminal presentation of the word had no semantic effects and no effect on people's preference for a beef sandwich over alternatives, but it did affect subjective ratings of hunger.

A few years later, Spence (1964; see also Spence & Ehrenberg, 1964) replicated Byrne's (1959) findings. He presented participants with words on a

screen. Between these words, Spence (1964) subliminally flashed the word *cheese*. After exposure to these words, participants were asked whether their hunger had increased, decreased, or remained the same as it was before the experiment. Of his 35 participants, 24 reported increased hunger, 9 reported decreased hunger, and 2 reported no change, a reliable effect. One may object here that experimenter demands are looming large, but this effect occurred only after 30 stimulus exposures and not after 5 stimulus exposures. An alternative explanation in terms of demand characteristics would have to explain why demands did not exert an effect in a condition that differed only in frequency of exposure.

Hawkins (1970) flashed either *Coke* or *Drink Coke* for 2.7 ms intervals during the presentation of unrelated supraliminal material. In a third, control group, participants were subliminally exposed to nonsense syllables. As expected, subjective thirst ratings were higher for both experimental groups than for the control group. Although the difference between the *Drink Coke* and the control group did not reach conventional levels of significance ($p < .06$), the difference between the *Coke* and the control condition was significant ($p < .022$).

One common objection is that there have been a few known failures to replicate these experiments (see e.g., Moore, 1982). Although this is important, these three experiments are themselves replications of the same phenomenon: Subliminally flashing words designating food or drinks can increase subjective hunger or thirst. Hence, simply concluding that subliminal manipulations of hunger or thirst cannot work is premature. However, the relation between subjectively felt needs such as hunger or thirst and actual consumer behavior is complex and presumably rather weak. As Moore (1982, p. 42) concluded, "even if the results are taken at face value, their relevance to advertising is minimal."

Drinking and Eating A second question is whether we can subliminally elicit drinking or eating behavior. Earlier work has already shown that subliminally activated personality traits or stereotypes can affect overt behavior (see Dijksterhuis & Bargh, 2001, for a review). Importantly, the effects of activated stereotypes and traits on overt behavior are mediated by the activation of behavior representations. For instance, activation of the stereotype of professors or the trait intelligence leads to activation of behavior representations such as "concentrate" or "think," which in turn affect actual performance on an intellectual task. Given that behavior is influenced by activation of behavior representations such as "think," one can hypothesize that the same can be expected from activation of a representation of, for instance, "drink."

We (Dijksterhuis, Wegner, & Aarts, 2001) tested this idea. Participants performed a standard lexical decision task. In total, participants were pre-

sented with 20 letter strings, either random letter strings or mundane, short words (e.g., *door*, *bike*). However, prior to the presentation of the words, other, subliminal words were flashed. In one condition, we flashed the word *drink*, in another condition we flashed the word *cola*, and in the control condition, we presented a four-letter random letter string. These words were flashed for 15 ms and were immediately masked by the target word. Importantly, when asked, none of the participants reported seeing anything prior to the target words. After participants finished the lexical decision task, the experimenter, who was blind to condition, announced the second task would be rather long and said, "I am going to have a drink. Do you want a drink as well? We have cola and mineral water." Participants who indicated they wanted a drink (the majority) were given the appropriate can. They then read text from the computer screen before the experimenter said the experiment was over. Both people in the drink prime condition ($M = 80$ cc) and people in the cola prime condition ($M = 96$ cc) drank more than people in the control condition ($M = 33$ cc). At the same time, however, the cola prime did not affect participants' choice of beverage.

Strahan, Spencer, and Zanna (2002) also obtained evidence for subliminally influencing drinking behavior. Participants in their experiment were asked not to eat or drink anything for 3 hours before the experimental session to make sure participants would arrive at the lab thirsty. Subsequently, participants were asked to taste cookies. Afterward, some participants were given a glass of water, allegedly to cleanse their palate. Hence, some participants were kept thirsty, whereas others were allowed to quench their thirst. Participants were then subliminally primed. In one condition, participants were subliminally presented with words associated with thirst (e.g., *thirst*, *dry*), whereas in the control condition they were presented with words unrelated to thirst. After this task, participants performed another taste test. They were asked to evaluate two beverages and were told they could drink as much as they wanted. Participants who had been presented with the thirst-related words drank significantly more than the control participants.

One may argue that advertisers are interested not so much in how much people drink but instead in what people drink. However, more drinking in general implies that people will also drink more of a particular drink. After all, in bars guests are often given salty food (such as peanuts) for free to get them to drink more. This is beneficial for both the owner of the bar and the manufacturer of a particular drink. Finally, it should also be noted that the size of both effects discussed here is considerable.

Choice The third question is whether one can influence the consumer choices people make via subliminal messages. Can we get people to choose Coca-Cola over Pepsi? A substantial literature in the advertising and marketing domain

is devoted to this question. In his review of this domain, Trappey (1996) listed previous narrative reviews. Out of nine earlier reviews (some covering more than choice behavior), five concluded that subliminal messages could affect behavior, whereas four concluded that there was no evidence for such effects. Based on his own meta-analytic review, he concluded that subliminal messages do have an effect on choice. However, he seemed to regret this, as he spent the better part of his discussion downplaying the importance of the effect. The combined effect size he reported is indeed small ($r = .06$), and Trappey said that it "falls between the effect of aspirin on heart attacks and the relationship between alcohol abuse and a tour of duty in Vietnam" (p. 527) and later concluded that it "is negligible" (p. 528).

But is this effect really that small? An r of .06 means that if without treatment 50 out of 100 people choose a certain product, after treatment 53 people would do so. Psychologically such an effect is small, but advertisers may have a different opinion. For multinational corporations, such a small effect corresponds—in theory at least—to millions of dollars. Moreover, one might wonder if supraliminal advertising techniques might perform better. Actually, a closer look reveals that it is very surprising that Trappey found an effect at all. In 17 out of the 23 experiments in the meta-analysis, the subliminal message was only presented once. It is a well-known fact that more frequent presentation of a message leads to greater psychological effects (e.g., Dijksterhuis & van Knippenberg, 1998; Higgins, Bargh & Lombardi, 1985; Marcel, 1983; Srull & Wyer, 1979, 1980).

Strahan and colleagues (2002) showed that subliminally influencing choices may work better in combination with supraliminal information among people who already have a relevant need. They invited thirsty participants to the laboratory. Some participants were presented with subliminally presented words related to thirst or with control words. Subsequently, participants were offered two drinks, Super Quencher and Power Pro. Super Quencher was advertised as the best thirst-quenching beverage on the market, while Power Pro was not so advertised. Interestingly, participants who had not been presented with the thirst-related words indicated no preference, despite the fact that they were thirsty, whereas participants who had been presented with the thirst-related words had a clear preference for Super Quencher. In other words, if one is already thirsty, a relevant advertisement can be more "convincing" if it is accompanied by subliminal messages. Importantly, Strahan and colleagues replicated this effect a number of times.

Now where do all these results leave us? It seems to be possible to subliminally influence people's self-reported thirst or hunger. It seems to be possible to subliminally affect the amount people consume. Finally, it may be possible to subliminally affect choices. On the one hand, it is certainly premature to claim that subliminal advertising does work and that we should seri-

ously think about guarding ourselves against it. On the other hand, the evidence is definitely strong enough to say that commercial applications of subliminal stimulation can, in principle, work, and that we should not treat them as a myth unworthy of investigation. Instead, we should study applications of subliminal stimulation to come to an objective appreciation of exactly what is, and what is not, possible. The least we should conclude is that the possibility that one or another form of subliminal advertising will be shown to have an effect is much greater than the possibility that people will learn to turn lead into gold. And if not, it really is time to buy a lot of lead.

Improving Health

Various companies have abused the popular belief in the power of subliminal phenomena by marketing subliminal self-help devices. For instance, customers can buy audiotapes in which subliminal messages are hidden. Supposedly, by processing subliminal messages such as "I feel fantastic this morning" or "Let's stay away from the pizza in the refrigerator today," people will feel better or lose weight.

During the 1980s, self-help audiotapes were so popular in the United States that various scientists were prompted to test their effectiveness. For example, Greenwald, Spangenberg, Pratkanis, and Eskenazi (1991) tested the effects of two tapes, one designed to improve memory and the other designed to improve self-esteem. Greenwald and colleagues switched some of the labels on the tapes before handing them to their participants. The participants listened to the tapes each day for a 1-month period, and both before and after this period, self-esteem and memory performance were assessed. The results were clear: All that was found was a placebo effect. The labels on the tapes had an effect, but the subliminal messages on the tapes did not. At about the same time, various other researchers tested self-help tapes (e.g., Russell, Rowe, & Smouse, 1991) and reached the same conclusion: Subliminal self-help messages do not have any effect at all.⁵

Does this mean that physical or mental health cannot benefit from the processing of subliminal stimuli? That conclusion is premature, because these experiments all investigated auditory subliminal perception. Visual subliminal perception may be generally more effective than auditory subliminal perception. Both Mayer and Merkelbach (1999) and Theus (1994) have remarked that the probability that subliminal stimuli are cognitively processed is much higher for visual than for auditory stimuli. This may be partly caused by the difference between the human processing capacity for visual versus auditory stimuli.

Recently, various companies have advertised self-help devices that use visual subliminal stimuli. When connected to a VCR, such a device presents subliminal messages on a TV screen. Customers may lose weight, reduce stress, and improve self-esteem while they watch the Superbowl or *Oprah*. We do not know whether these devices have been scientifically tested. Though visual subliminal stimulation is more likely to be effective than auditory stimulation, we should not yet be optimistic. One device (made by a company called Motivision) presents subliminal messages that are rather long (20–40 letters). Greenwald (1992; see also Abrams & Greenwald, 2000; but see Silverman, 1976) has already showed that subliminally presenting anything more than a single word is a hazardous affair, whereas short sentences are unlikely to have any effect at all. Assuming that people can pick up bits and pieces of a sentence, the subliminal presentation of a sentence such as “Do not eat much” can have various consequences. Unfortunately, the probability that it urges people to eat more (when only “eat” or “eat much” are perceived) is higher than the probability that it urges people to eat less (for which the entire sentence is needed).

But what if we subliminally present single words? Recently, Dijksterhuis (2001) started to test the idea that subliminal exposure to stimuli related to relaxation may affect cardiovascular activity. It has often been demonstrated that consciously thinking or imagining relaxation can have a profound impact on autonomic processes such as heart rate (Jones & Johnson, 1980; Lucini et al., 1997), respiration rate (Jones & Johnson, 1980), and skin resistance (Himle, 1973). In our view, the critical mediator causing these changes in autonomic functioning is not the conscious imagination but rather the activation of the mental representation of relaxation. In our experiment, participants were asked to watch a computer screen during three 1-minute task periods. These periods were separated by 1-minute breaks. During the second task period, participants were subliminally presented with either the word *rest* or *relax* every 3 s. The words remained on the screen for only 15 ms and were both premasked and postmasked by random letter strings. The first and third task periods, during which only the pre- and postmasks appeared, were used as controls. Heart rate was measured throughout these three task periods. Heart rate was indeed significantly lower ($M = 70.3$ bpm) during the experimental 1-minute period relative to the two control periods ($M = 72.1$ bpm). Subliminal stimulation, then, indeed affects cardiovascular activity. At about the same time, Hull, Slone, and Matthews (2001) obtained comparable results in two different experiments. They subliminally presented participants (17 ms) with words such as *angry* or *relax*. Immediately afterward, systolic and diastolic blood pressure was lower for the participants presented with the word *relax* than for participants presented with the word *angry*.

Of course, these findings should not be taken as evidence that we can now design self-help devices to reduce stress. The effects obtained in the cited stud-

ies decay quickly and the effects are small in size. Still, they are enough reason to take the idea seriously and to continue to investigate effects of subliminal stimulation on health.

Conclusion: Three Good Reasons for Investigating Subliminal Phenomena

In closing, we would like to give three good reasons for taking the domain seriously and for doing scientific research on subliminal phenomena. The first reason regards the potential beneficial use of subliminal stimulation. Self-help tapes have been proven to be ineffective, but it seems worthwhile to continue to study other possibilities. The studies demonstrating that heart rate and blood pressure can be temporarily decreased by subliminal stimulation provide enough evidence to give the idea of subliminal stimulation to promote health another chance.

The second reason regards the abuse of subliminal stimulation. The idea of subliminal influence has met with strong aversion. People do not want to be subliminally steered toward buying "toothpaste X" and certainly not toward voting for a particular political candidate. Nobody wants to pay \$200 for some ineffective health-improving device. However, we should be aware that subliminal techniques are applied and sold, and we can act to decrease or maybe even stop this abuse. One way would be legislation. Another way would be to objectively inform society about the effectiveness or ineffectiveness of certain techniques. Importantly, whatever we choose, it is necessary to first come to know what is possible and what is not.

The third reason is purely scientific. If, in a certain area, a few findings have been documented and a few articles have been published, this usually leads more people to investigate these findings. Researchers abandon a domain for a limited number of reasons: They know everything they want to know; they conclude it does not lead to something substantial; or they simply stop being fascinated by a certain topic. None of these reasons is relevant to the application of subliminal stimulation. We do not know much yet; we cannot say that it does not lead to something; and many people are fascinated by findings such as the ones presented in this chapter. Instead, the reason that so little research has been done is emotional. Vicary and others (e.g., Key, 1989) have influenced popular beliefs about subliminal research based on shoddy research. In reaction, the vast majority of the psychological community has claimed that subliminal persuasion cannot work and that we should remove it from the agenda. This, however, is simply unscientific. If, as scientists, we base our statements on things other than sound research, science itself will become superfluous.

Acknowledgments The authors would like to thank Tony Greenwald and the editors for very helpful comments on an earlier draft.

Notes

1. Kihlstrom, Barnhardt, and Tataryn (1992) point out that the Peirce and Jastrow studies were not just the first experiments on subliminal perception, but also the first American psychological experiments: These were the first studies conducted at Hopkins, the first psychological laboratory in America.

2. We concede that we cannot guarantee that all experiments cited in this chapter do indeed fit this definition. An awareness check is needed to rule out the possibility that participants could perceive stimuli consciously. While most authors report such a check, a few (mainly in older articles) do not.

3. Of course, at any point in time it is not the case that our total processing capacity is aimed at one "target" (such as judging an apartment). But even if one assumes that only a small part of the overall processing capacity was devoted to judging the apartment, it is likely that far more relevant information was dealt with unconsciously than consciously.

4. Although subliminally presented words can be classified on the basis of their valence, Abrams and Greenwald (2000) demonstrated that under some circumstances subliminal perception leads to processing only word parts. For instance, repeated exposure to the negative words *smut* and *bile* leads to a negative evaluation of the subliminally presented word *smile*. In other words, rather than processing *smile* as a whole, participants processed the word parts *sm* and *ile* that were both evaluated negatively due to earlier exposure to *smut* and *bile*. These results should not be taken as evidence that people can only process word parts subliminally, as such a conclusion is at odds with much other research. Rather, these results show that under some circumstances word parts are given more weight during processing of subliminal stimuli than entire words.

5. At about the same time, religious fanatics accused the rock band Judas Priest of hiding subliminal messages (actually, backward messages) in their music that supposedly caused the suicide of a 10-year-old boy. As one might expect, people cannot make sense of backward speech. Begg, Needham, and Bookbinder (1993; see also Vokey & Read, 1985) have shown that people cannot differentiate between backward nursery rhymes, Christian messages, Satanic messages, or pornography.

This should not be taken as evidence that subliminal self-help tapes cannot have an effect. The tapes that were tested were designed for commercial use by people who did not quite know what they were doing (other than trying to make money). They certainly knew much less about subliminal influence than most, if not all, of the people cited in this chapter.

References

- Abrams, R. L., & Greenwald, A. G. (2000). Parts outweigh the whole (word) in unconscious analysis of meaning. *Psychological Science*, 11, 118–124.

- Adams, J. K. (1957). Laboratory studies of behavior without awareness. *Psychology Bulletin*, 54, 383-405.
- Baeyens, F., Crombez, G., van den Bergh, O., & Eelen, P. (1988). Once in contact always in contact: Evaluative conditioning is resistant to extinction. *Advances in Behavior Research and Therapy*, 10, 179-199.
- Baeyens, F., Eelen, P., Crombez, G., & van den Bergh, O. (1992). Human evaluative conditioning: Acquisition trials, presentation schedule, evaluative style and contingency awareness. *Behaviour Research and Therapy*, 30, 133-142.
- Bargh, J. A. (1989). Conditional automaticity: Varieties of automatic influence in social perception and cognition. In J. S. Uleman & J. A. Bargh (Eds.), *Unintended thought* (pp. 3-51). New York: Guilford.
- Bargh, J. A. (1992). Being unaware of a stimulus versus unaware of its interpretation: Why subliminality per se does not matter to social psychology. In R. Bornstein & T. Pittman (Eds.), *Perception without awareness* (pp. 236-255). New York: Guilford.
- Bargh, J. A., Chen, M., & Burrows, L. (1996). The automaticity of social behavior: Direct effects of trait concept and stereotype activation on action. *Journal of Personality and Social Psychology*, 71, 230-244.
- Bargh, J. A., & Pietromonaco, P. (1982). Automatic information processing and social perception: The influence of trait information presented outside of conscious awareness on impression formation. *Journal of Personality and Social Psychology*, 43, 437-449.
- Begg, I. M., Needham, D. R., & Bookbinder, M. (1993). Do backward messages unconsciously affect listeners? No. *Canadian Journal of Experimental Psychology*, 47, 1-14.
- Berke, R. L. (2000, September 12). Democrats see, and smell, rats in G.O.P. ad. *New York Times*, p. 1.
- Bornstein, R. F. (1992). Subliminal mere exposure effects. In R. F. Bornstein & T. S. Pittman (Eds.), *Perception without awareness: Cognitive, clinical and social perspectives* (pp. 191-210). New York: Guilford.
- Bruni, F. (2000, September 13). Bush says rats reference in ad was unintentional. *New York Times*, p. 19.
- Byrne, D. (1959). The effect of a subliminal food stimulus on verbal response. *Journal of Applied Psychology*, 43, 249-252.
- Cacioppo, J. T., Marshall-Goodell, B. S., Tassinary, L. G., & Petty, R. E. (1992). Rudimentary determinants of attitudes: Classical conditioning is more effective when prior knowledge about the attitude stimulus is low than high. *Journal of Experimental Social Psychology*, 28, 207-233.
- Cheesman, J., & Merikle, P. M. (1984). Priming with and without awareness. *Perception and Psychophysics*, 36, 387-395.
- Cheesman, J., & Merikle, P. M. (1986). Distinguishing conscious from unconscious perceptual processes. *Canadian Journal of Psychology*, 40, 343-367.
- Chen, M., & Bargh, J. A. (1997). Nonconscious behavioral confirmation processes: The self-fulfilling nature of automatically activated stereotypes. *Journal of Experimental Social Psychology*, 33, 541-560.
- Damasio, A. R. (1994). *Descartes' error: Emotion, reason and the human brain*. New York: Avon Books.
- Davey, G. C. L. (1993). Defining the important theoretical questions to ask about evaluative conditioning: A reply to Martin and Levey. *Behaviour Research and Therapy*, 32, 307-310.

- Debnar, J. A., & Jacoby, L. L. (1994). Unconscious perception: Attention, awareness, and control. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 20, 304-317.
- Dehaene, S., Naccache, L., Le Clec'H, G., Keochlin, E., Mueller, M., Dehaene-Lambertz, G., van de Moortele, P., & Le Bihan, D. (1998). Imaging unconscious semantic priming. *Nature*, 395, 597-600.
- De Houwer, J., Baeyens, F., & Eelen, P. (1994). Verbal conditioning with undetected US presentations. *Behavior Research and Therapy*, 32, 629-633.
- De Houwer, J., Hendrickx, H., & Baeyens, F. (1997). Evaluative learning with "subliminally" presented stimuli. *Consciousness and Cognition*, 6, 87-107.
- De Houwer, J., Thomas, S., & Baeyens, F. (2001). Associative learning of likes and dislikes: A review of 25 years of research on human evaluative conditioning. *Psychological Bulletin*, 127, 853-869.
- Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, 56, 5-18.
- Dijksterhuis, A. (2001). Unconscious relaxation: The influence of subliminal priming on heart rate. Unpublished manuscript, University of Amsterdam.
- Dijksterhuis, A., Aarts, H., Bargh, J. A., & van Knippenberg, A. (2000). On the relation between associative strength and automatic behavior. *Journal of Experimental Social Psychology*, 36, 531-544.
- Dijksterhuis, A., & Bargh, J. A. (2001). The perception-behavior expressway: The automatic effects of social perception on social behavior. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 33, pp. 1-40). San Diego, CA: Academic Press.
- Dijksterhuis, A., Bargh, J. A., & Miedema, J. (2000). Of men and mackerels: Attention and automatic behavior. In H. Bless & J. P. Forgas (Eds.), *Subjective experience in social cognition and behavior* (pp. 36-51). Philadelphia: Psychology Press.
- Dijksterhuis, A., & Corneille, O. (2001). On the relation between stereotype activation and intellectual performance. Unpublished manuscript, University of Amsterdam.
- Dijksterhuis, A., Spears, R., Postmes, T., Stapel, D. A., Koomen, W., van Knippenberg, A., & Scheepers, D. (1998). Seeing one thing and doing another: Contrast effects in automatic behavior. *Journal of Personality and Social Psychology*, 75, 862-871.
- Dijksterhuis, A., & van Knippenberg, A. (1998). The relation between perception and behavior or how to win a game of Trivial Pursuit. *Journal of Personality and Social Psychology*, 74, 865-877.
- Dijksterhuis, A., Wegner, D. M., & Aarts, H. (2001). Unpublished data set.
- Dixon, N. F. (1971). *Subliminal perception*. New York: McGraw-Hill.
- Dixon, N. F. (1981). *Preconscious processing*. New York: Wiley.
- Dixon, N. F. (1986). On private events and brain events. *Behavioral and Brain Sciences*, 9, 29-30.
- Dovidio, J. F., Evans, N., & Tyler, R. B. (1986). Racial stereotypes: The contents of their cognitive representations. *Journal of Experimental Social Psychology*, 22, 22-37.
- Eriksen, C. W. (1960). Discrimination and learning without awareness: A methodological survey and evaluation. *Psychological Review*, 67, 279-300.
- Fazio, R. H. (1990). Multiple processes by which attitudes guide behavior: The MODE model as an integrative framework. In M. P. Zanna (Ed.), *Advances in*

- Experimental Social Psychology* (Vol. 23, pp. 75–109). New York: Academic Press.
- Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology*, 50, 229–238.
- Feynman, R. P. (1985). *Surely you're joking, Mr. Feynman*. New York: Bantam Books.
- Field, A. P. (2000). I like it, but I'm not sure why: Can evaluative conditioning occur without conscious awareness? *Consciousness and Cognition*, 9, 13–36.
- Fowler, C. (1986). An operational definition of conscious awareness must be responsible to subjective experience. *Behavioral and Brain Sciences*, 9, 33–35.
- Greenwald, A. G. (1992). New Look 3: Unconscious cognition reclaimed. *American Psychologist*, 47, 766–779.
- Greenwald, A. G., Draine, S., & Abrams, R. (1996). Three cognitive markers of unconscious semantic activation. *Science*, 273, 1699–1702.
- Greenwald, A. G., Klinger, M. R., & Liu, T. J. (1989). Unconscious processing of dichoptically masked words. *Memory and Cognition*, 17, 35–47.
- Greenwald, A. G., Klinger, M. R., & Schuh, E. S. (1995). Activation by marginally perceptible ("subliminal") stimuli: Dissociation of unconscious from conscious cognition. *Journal of Experimental Psychology: General*, 124, 22–42.
- Greenwald, A. G., Spangenberg, E. R., Pratkanis, A. R., & Eskenazi, J. (1991). Double-blind tests of subliminal self-help audiotapes. *Psychological Science*, 2, 119–122.
- Hammerl, M., & Grabitz, H. J. (1993). Human evaluative conditioning: Order of stimulus presentation. *Integrative Physiological and Behavioral Science*, 28, 191–194.
- Hawkins, D. (1970). The effects of subliminal stimulation on drive level and brand preference. *Journal of Marketing Research*, 8, 322–326.
- Higgins, E. T., Bargh, J. A., & Lombardi, W. (1985). Nature of priming effects on categorization. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 11, 59–69.
- Higgins, E. T., Rholes, W. S., & Jones, C. R. (1977). Category accessibility and impression formation. *Journal of Experimental Social Psychology*, 13, 141–154.
- Himle, D. P. (1973). Effects of instructions upon an autonomic response: An analogue of systematic desensitization. *Psychological Reports*, 32, 767–773.
- Holender, D. (1986). Semantic activation without conscious identification in dichotic listening, parafoveal vision, and visual masking: A survey and appraisal. *Behavioral and Brain Sciences*, 9, 1–66.
- Hull, J. G., Slone, L. B., & Matthews, A. R. (2001, February). *The non-consciousness of self-consciousness*. Poster presented at the second annual Society for Personality and Social Psychology Conference, San Antonio, TX.
- Jaynes, J. (1976). *The origin of consciousness in the breakdown of the bicameral mind*. Boston: Houghton Mifflin.
- Jones, G. E., & Johnson, H. J. (1980). Heart rate and somatic concomitants of mental imagery. *Psychophysiology*, 17, 339–347.
- Key, W. B. (1989). *The age of manipulation*. New York: Holt.
- Kihlstrom, J. F., Barnhardt, T. M., & Tataryn, D. J. (1992). Implicit perception. In R. F. Bornstein & T. S. Pittman (Eds.), *Perception without awareness: Cognitive, clinical and social perspectives* (pp. 17–54). New York: Guilford.
- Krosnick, J. A., Betz, A. L., Jussim, L. J., & Lynn, A. R. (1992). Subliminal conditioning of attitudes. *Personality and Social Psychology Bulletin*, 18, 152–162.

- Kunst-Wilson, W., & Zajonc, R. (1980). Affective discrimination of stimuli that cannot be recognized. *Science*, 207, 557-558.
- Küpfmüller, K. (1962). Nachrichtenverarbeitung im Menschen. In K. Steinbuch (Ed.), *Taschenbuch der Nachrichtenverarbeitung* (pp. 1481-1501). Berlin: Springer.
- Lepore, L., & Brown, R. (1997). Category and stereotype activation: Is prejudice inevitable? *Journal of Personality and Social Psychology*, 72, 275-287.
- Levey, A. B., & Martin, I. (1975). Classical conditioning of human "evaluative" responses. *Behavior Research and Therapy*, 13, 221-226.
- Libet, B. (1985). Unconscious cerebral initiative and the role of conscious will in voluntary action. *Behavioral and Brain Sciences*, 8, 529-566.
- Libet, B., Alberts, W. W., Wright, E. W., & Feinstein, B. (1967). Responses of human somatosensory cortex to stimuli below threshold for conscious sensation. *Science*, 158, 1597-1600.
- Lucini, D., Covacci, G., Milani, R., Mela, G. S., Malliani, A., & Pagani, M. (1997). A controlled study of effects of mental relaxation on autonomic excitatory responses in healthy subjects. *Psychosomatic Medicine*, 59, 541-552.
- Marcel, A. J. (1983). Conscious and unconscious perception: An approach to the relations between phenomenal experience and perceptual processes. *Cognitive Psychology*, 15, 238-300.
- Mayer, B., & Merkelbach, H. (1999). Unconscious processes, subliminal stimulation, and anxiety. *Clinical Psychology Review*, 19, 571-590.
- Merikle, P. M., Joordens, S., & Stolz, J. A. (1995). Measuring the relative magnitude of unconscious influences. *Consciousness and Cognition*, 4, 422-439.
- Merikle, P. M., & Reingold, E. M. (1992). Measuring unconscious perceptual processes. In R. F. Bornstein & T. S. Pittman (Eds.), *Perception without awareness: Cognitive, clinical and social perspectives* (pp. 55-80). New York: Guilford.
- Monteith, M. J., Devine, P. G., & Sherman, J. W. (1998). Suppression as a stereotype control strategy. *Personality and Social Psychology Review*, 2, 63-82.
- Moore, T. E. (1982). Subliminal advertising: What you see is what you get. *Journal of Marketing*, 46, 38-47.
- Murphy, S., Monahan, J., & Zajonc, R. B. (1995). Additivity of nonconscious affect: Combined effects of priming and exposure. *Journal of Personality and Social Psychology*, 69, 589-602.
- Murphy, S., & Zajonc, R. B. (1993). Affect, cognition, and awareness: Affective priming with optimal and suboptimal stimulus exposures. *Journal of Personality and Social Psychology*, 64, 723-739.
- Niedenthal, P. M. (1990). Implicit perception of affective information. *Journal of Experimental Social Psychology*, 26, 505-527.
- Nisbett, R., & Wilson, D. T. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, 84, 231-259.
- Nørretranders, T. (1998). *The user illusion: Cutting consciousness down to size*. New York: Viking.
- Olson, M. A., & Fazio, R. H. (2001). Implicit attitude formation through classical conditioning. *Psychological Science*, 12, 413-417.
- Paap, K. R. (1986). The pilfering of awareness and guilt by association. *Behavioral and Brain Sciences*, 9, 45-46.
- Packard, V. (1978). *The people shapers*. London: MacDonald and Jane's.
- Peirce, C. S., & Jastrow, J. (1884). On small differences in sensation. *Memoirs of the National Academy of Science*, 3, 75-83.

- Pötzl, O. (1960). The relationship between experimentally induced dream images and indirect vision (J. Wolff, D. Rapoport, & S. Annin, Trans.). *Psychological Issues*, 3(7), 41-120. (Original work published 1917)
- Pratkanis, A. R. (1992). The cargo-cult science of subliminal persuasion. *Skeptical Inquirer*, 16, 260-272.
- Razran, G. H. S. (1940). Conditioned response changes in rating and appraising sociopolitical slogans. *Psychological Bulletin*, 37, 481.
- Rogers, M., & Smith, K. H. (1993, March/April). Public perceptions of subliminal advertising: Why practitioners shouldn't ignore the issue. *Journal of Advertising Research*, pp. 10-18.
- Russell, T. G., Rowe, W., & Smouse, A. D. (1991). Subliminal self-help tapes and academic achievement: An evaluation. *Journal of Counseling and Development*, 69, 359-362.
- Shimp, T. A., Stuart, E. W., & Engle, R. W. (1991). A program of classical conditioning experiments testing variations in the conditioned stimulus and context. *Journal of Consumer Research*, 18, 1-12.
- Sidis, B. (1898). *The psychology of suggestion*. New York: D. Appleton.
- Silverman, L. H. (1976). Psychoanalytic theory: The reports of my death are greatly exaggerated. *American Psychologist*, 31, 621-637.
- Spence, D. P. (1964). Effects of a continuously flashing subliminal verbal food stimulus on subjective hunger ratings. *Psychological Reports*, 15, 993-994.
- Spence, D. P., & Ehrenberg, B. (1964). Effects of oral deprivation on responses to subliminal and supraliminal verbal food stimuli. *Journal of Abnormal and Social Psychology*, 69, 10-18.
- Srull, T. K., & Wyer, R. S., Jr. (1979). The role of category accessibility in the interpretation of information about persons: Some determinants and implications. *Journal of Personality and Social Psychology*, 37, 1660-1672.
- Srull, T. K., & Wyer, R. S., Jr. (1980). Category accessibility and social perception: Some implications for the study of person memory and interpersonal judgments. *Journal of Personality and Social Psychology*, 38, 841-856.
- Staats, A. W., & Staats, C. K. (1958). Attitudes established by classical conditioning. *Journal of Abnormal and Social Psychology*, 57, 37-40.
- Staats, A. W., Staats, C. K., & Crawford, H. L. (1962). First order conditioning of meaning and the parallel conditioning of a GSR. *Journal of General Psychology*, 67, 159-162.
- Staats, C. K., & Staats, A. W. (1957). Meaning established by classical conditioning. *Journal of Experimental Psychology*, 54, 74-80.
- Strahan, E. J., Spencer, S. J., & Zanna, M. P. (2002). Subliminal priming and persuasion: Striking while the iron is hot. *Journal of Experimental Social Psychology*, 38, 556-568.
- Stuart, E. W., Shimp, T. A., & Engle, R. W. (1987). Classical conditioning of consumer attitudes: Four experiments in an advertising context. *Journal of Consumer Research*, 14, 334-349.
- Theus, K. T. (1994). Subliminal advertising and the psychology of processing unconscious stimuli: A review of research. *Psychology and Marketing*, 11, 271-290.
- Trappey, C. (1996). A meta-analysis of consumer choice and subliminal advertising. *Psychology and Marketing*, 13, 517-530.
- Vokey, J. R., & Read, J. D. (1985). Subliminal messages: Between the devil and the media. *American Psychologist*, 40, 1231-1239.
- Watt, H. J. (1905). Experimentelle beitrage zur einer theorie des denkens. *Archiv für Geschichte der Psychologie*, 4, 289-436.
- Whalen, P. J., Rauch, S. L., Etcoff, N. L., McInerney, S. C., Lee, M. B., & Jenike, M. A. (1998). Masked presentations of emotional facial expressions modulate amygdala activity without explicit knowledge. *Journal of Neuroscience*, 18, 411-418.
- Wolford, G. (1986). A review of the literature with and without awareness. *Behavioral and Brain Sciences*, 9, 49-50.
- Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 9, 1-27.
- Zanot, E. J., Pincus, J. D., & Lamp, E. J. (1983). Public perceptions of subliminal advertising. *Journal of Advertising*, 12, 37-45.
- Zimmermann, M. (1989). The nervous system in the context of information theory. In R. F. Schmidt & G. Thews (Eds.), *Human physiology* (pp. 166-173). Berlin: Springer.