

Studying the Mind in the Middle: A Practical Guide to Priming and Automaticity Research

John A. Bargh and Tanya L. Chartrand
New York University

Though it might be hard for fledgling researchers of today to believe, for most of the 20th century, invoking cognitive mechanisms and processes to explain and model psychological phenomena was not allowed.¹ The reason for this was because the only known research technique to examine these internal mental states was introspection and self-report. This method was seen to be fatally flawed in that an objective outside observer could not make the measurements – and so the data could not be independently verified. Other sciences did not confuse the observer with the observed, and so, it was said, neither should psychology if it wanted to be considered a science. In his book *The Ghost in the Machine*, Arthur Koestler (1967) observed that this dedicated neglect of its natural subject matter caused psychology to go nowhere, at a time in history when the other sciences, in contrast, were making giant strides forward.

But things are very different today. The research methods and techniques described in this chapter are a major reason why we now have a scientific social cognitive psychology. The methods described are not of self-report, they are made by outside observers and are replicable by other outside observers. Instead of introspection, as a field we have learned how to make inferences about cognitive process and structure from response latencies, and from the order in which our participants recall stimuli about people and events, about what happens when

the mental system is put under stress, as when the individual has to do several different things at once. For the most part, we do not have to rely solely on the person's own description of their internal state – like the nuclear physicist inferring atomic structure from lines on a photographic plate, we can infer mental structure from 25 millisecond differences in the time taken to pronounce a specific word. One cannot “see” inside another's mind, but neither can the physicist “see” quarks and muons inside the atom. Just as do other sciences, we infer, deduce, and build theories about the mind based on observables; generating falsifiable predictions and putting them to the test. (And we can even use introspection and self-report, because we are able to verify and check these data against the other, independent means.)

The present chapter is a summary of the methods commonly used to explore the cognitive representations and processes that mediate between environmental events and psychological reactions to them – whether those responses be impressions, evaluations, goals, or behavior. We focus primarily on passive, or unintentional, forms of cognitive mediation in an attempt to keep it distinct from motivational mediation as much as possible. Goal effects on information processing and behavior are purposive and strategic (by definition) and not strictly due to cognitive structure or process per se (for a comprehensive recent review, see Gollwitzer & Moskowitz, 1996). But motivation and cognition are highly if not inextricably related (Gollwitzer & Bargh, 1996; Sorrentino & Higgins, 1986) and the reader of the present chapter will find many references to the intersection of the two – for instance, in the unintended carry over effects of a goal chosen intentionally in one context to a subsequent context. We hope by maintaining a focus on passive or unintentional effects, we will keep to the theme of how to study the mental representations and processes

¹ This chapter was written while the senior author was a visiting professor at the University of Konstanz. Its preparation was supported in part by Grant SBR-9409448 from the National Science Foundation, and by a fellowship from the Alexander von Humboldt Foundation. We thank the editors and Miguel Brendl, Peter Gollwitzer, Asher Koriat, Katelyn McKenna, James Uleman, Wolfgang Wasel, and Gifford Weary for their advice and suggestions. Authors' address: Department of Psychology, New York University, Seventh Floor, 6 Washington Place, New York, NY 10003.

that mediate and moderate social psychological phenomena.

Priming and automaticity research techniques share a concern with the ways that internal mental states mediate, in a passive and hidden manner, the effects of the social environment on psychological processes and responses. Automaticity techniques enable an experimenter to measure the particular mental procedures or representations that are assumed, in his or her theory, to correspond to the individual differences in a phenomenon. For example, Dodge (e.g., 1993) has argued that violent boys differ from other boys in the ways that they automatically perceive the aggressive intentions of others. Many depression researchers, starting with Aaron Beck (1967), have proposed that depressives tend to automatically think of themselves in negative terms and so suffer low self-worth, without having much awareness of how those feelings come about. Priming studies, on the other hand, are more concerned with effects of the current situational context, and how these environmental features cause the average individual to think, feel, and behave differently than otherwise.

Today, nearly a quarter century after Mischel (1973) proposed the emergence of social and personality psychology — that is, the study of individual differences in reactions to situational forces — the existence of individual differences in perception is well established in the field. Yet only 50 years ago it was a radical thing (in experimental psychology) to suggest that one's experience of the outside world was determined by anything other than the stimulation "out there." We would like to start our treatment of cognitive research methods by presenting a brief history of cognitive mediation in psychology: first, the breakthrough idea that people could differ in what they perceived in the environment, and how they perceived it, followed by the various reasons found for these individual variations. The mind was not always in the middle of psychological explanation; here is how it got there.

THE INFLUENCE OF INTERNAL STATES ON PERCEPTUAL EXPERIENCE

The early elementalist approach of Wundt and Titchener held that perception was explicable entirely in terms of discrete sensory events; indeed, any reference to perception of *objects per se* by the introspecting perceiver (instead of to the sensory features present in that object) was held to be going beyond the information present — an inference, not

something actually perceived (see Boring, 1950). The Gestalt movement, in fact, arose in direct opposition to the elementalist approach. The Gestaltists argued that people did indeed go beyond the information given, perceiving objects as wholes according to precise principles of form and relations that were not reducible to the sensory stimulation alone (Koffka, 1922).

The study of visual illusions provided the Gestalt movement with many powerful demonstrations that these *emergent* properties of the stimulus — and not merely the actual stimulus present — produced perceptions of size, distance, and brightness (see Boring, 1950). For example, a black and white photograph of a woman in a white dress, standing next to a man wearing a dark suit, appears phenomenally the same under varying lighting conditions. This is despite the fact that the dark suit under the brighter lighting is actually the same (physically speaking) shade of grey as the white dress had been under the darker lighting.

INDIVIDUAL DIFFERENCES IN PERCEPTUAL EXPERIENCE

When Christian Dior launched his "New Look" in fashion design in 1947, little did he know that he was also supplying the name for a radical movement in human perception research. What we know now as the New Look in perception was a break from the then dominant assumption that perceptual experience was determined solely by properties of the stimulus field (including the Gestaltists' emergent properties). For the first time, it was proposed that there could be individual differences in perceptual processing.

While the Gestaltists showed that people go beyond the information present in the environment, the mechanisms by which they did so were still regarded as universal. Individual variation around the grand mean of judgments of intensity or other stimulus features was treated as error variance. But it had been noticed that there were consistent individual differences in these errors. Some experimental participants were consistently on the low side of the mean, with others usually on the high side, and this became known, somewhat oxymoronically, as the "constant error".

If these deviations had been merely random noise, a given individual would have been expected to vary randomly — not systematically — around the mean in his or her judgments. Recognizing this, Bruner and Postman (1947) proposed that these constant errors were not errors at all, but true

individual differences in perceptual experience. Moreover, they surmised that the observed individual differences were perhaps correlated with other individual differences, such as in motivations, needs, and values. The New Look in perception was born.

Suddenly, entire areas of psychological inquiry – attitudes and values, emotion, motivation and goal research, personality, clinical and psychodynamic theory – had a bridge to experimental psychology. New Look research boomed as these researchers explored the effects of their particular brand of individual difference on perceptual experience (see reviews by Allport, 1955; Bruner, 1957; Dixon, 1971; Erdelyi, 1974). In a very real way, it was the birth not just of a fruitful avenue of perception research, but of a truly general experimental psychology, as the laboratory techniques that had long been associated with “scientific” psychology could now be exploited by these other areas.

A BRIEF HISTORY OF PRIMING AND AUTOMATICITY

The Roots of Priming Research

While the New Look did champion the role played by individual differences in motives and needs in perceptual experience, nowhere in it was there a mention of what we now refer to as priming – how recent or current experience *passively* (without an intervening act of will) creates internal readinesses. Bruner’s (1957) classic statement of category accessibility theory described how current goals and purposes caused representations relevant to achieving those goals to become more accessible and ready to be activated by their corresponding objects and events in the environment. But this was a quite active and intentional internal state.

Recent Experience as an Individual Difference

A closer historical precedent to present-day research on passive contextual effects is Duncker’s (1945) pioneering work on mind-sets and creativity. Duncker showed that a person’s usual way of thinking about objects and their functions sometimes gets in the way of coming up with novel, creative solutions to problems. For example, let’s say Joe is given the task of tying together two pieces of string dangling far enough apart that he can’t grasp the one piece without letting go of the other. Joe also has a hammer at his disposal, but on his own he can’t figure out how it could help him to complete the task. However, as soon as the experimenter sets one of the dangling threads into motion, it occurs to Joe to tie the hammer

to the end of the string in order to set it in motion like a pendulum. Importantly, Joe is not aware of the effect that the experimenter’s knocking the string into motion had on his (Joe’s) arrival at the correct solution. Today, we understand this phenomenon as a case of passive conceptual priming – the concept, in this case, being that of motion. This activated concept becomes more likely than before to influence conscious judgments and problem-solving.

In fact, Higgins and Chaires (1980) demonstrated how solutions to the Duncker candle problem could be produced using the more modern priming techniques discussed in this chapter. By exposing the participant repeatedly to the word “or” as part of an apparently unrelated experiment, he or she was more likely to see a box of tacks as two separate objects, a box and some tacks, compared to participants previously exposed to the word “and”. This was shown by the “or-primed participants’ greater success rate in solving a puzzle in which the box had to be tacked to a wall in order to form a platform for the candle.

The first use of the term “priming” to refer to the temporary internal activation of response tendencies was by Karl Lashley in a 1951 paper. Lashley was dealing with the problem of how serial response sequences, as in speech production, flow so quickly and apparently effortlessly. He argued that there had to be a mediating state intervening between the act of will or intention, and the production of the intended behavior, which assembled the action into the proper serial sequence. This he called the *priming* of the response.

The idea of priming thus entered the literature to refer to a preparedness of mental representations to serve a response function. Yet the activation Lashley described came from internal, and even intentional, sources. It took a bit of serendipity for the phenomenon of passive priming influences to be discovered.

This was provided by Storms (1958), who first gave his participants a list of words to memorize, and then had them free associate to a series of stimulus words. Unexpectedly, Storms found that the words presented in the memory task became more likely than usual to be given as associates (compared to standard free associate norms). Storms reported this effect but could not explain it, concluding that “the mechanisms of this recency effect remain unexplored” (p. 394).

It was Segal and Cofer (1960) who first used the term "priming" to refer to this effect of recent use of a concept in one task on its probability of usage in a subsequent, unrelated task.² Segal and Cofer replicated Storms' finding, but, critically, without the use of explicit recall instructions — merely exposing participants to the list of words had the effect of increasing the probability that those words would be used in the subsequent free association task.

Following this initial demonstration, priming began to be used as an experimental technique, especially to show how information had been stored in memory despite the individual's inability to recall it (Grand & Segal, 1966; Koriat & Feuerstein, 1976; Segal, 1967). That is, words presented in a first task still were more likely than usual to show up as free associates in a subsequent task, even though participants had failed to recall them at the end of the first task. These early priming studies were thus the forerunners of the important contemporary distinction between implicit and explicit forms and uses of memory (e.g., Greenwald & Banaji, 1995; Schacter, 1987).

Priming in Social Psychology

For social psychology, the ground-breaking priming study came when Higgins, Rholes, and Jones (1977) showed that personality trait concepts (such as *adventurous* or *independent*) — not just single words — could be primed by recent use. Using the same unrelated studies paradigm as had Segal and his colleagues, Higgins et al. (1977) exposed participants to synonyms of certain personality traits as part of a first, memory experiment. Next, in what participants believed to be an unrelated experiment, they read about a target person named Donald who behaved in ways ambiguously related to the primed traits, such as sailing across the ocean alone, and preferring to study by himself. Those participants who had been exposed to words such as "adventurous" and "independent" formed more positive impressions of Donald than did participants who had been previously exposed to relevant terms such as "reckless" and "aloof." Importantly, participants evidenced no awareness of having been influenced by their prior exposure to trait terms in the earlier memory experiment.

The advance beyond previous priming studies was that the participants' response did not involve

using the prime words themselves, as in the free association task studies; instead their overall impression or evaluation of Donald was requested. What had been primed was not just the single, concrete lexical memory locations corresponding to the stimulus words, therefore, but also the abstract trait concepts. These in turn became more likely to capture the relevant but ambiguous behavioral information, thus slanting final impressions in the positive or negative direction.

The Higgins et al. (1977) study revealed for the first time how an individual's recent experience could affect — in a passive and unintended way — his or her perceptual interpretation of another person's behavior. In their study, all participants read about the same target person doing the same things, yet they came away from their reading with markedly different impressions of that person — differences that were only accountable by reference to the manipulated differences in their recent use of the trait concepts.

The Roots of Automaticity Research

Priming and automaticity research have a common purpose: to explore the effects of individual differences in accessibility of mental representations on perception, evaluation, motivation, and behavior. However, while priming research centers on the *temporary* activation of an individual's mental representations by the environment and the effect of this activation on various psychological phenomena, automaticity research focuses on more *permanent*, "hard-wired" sources of activation — that is, chronic accessibility of social knowledge structures. We now turn to the development of the present-day conception of automaticity.

It is now widely held that automatic processing is not a singular entity, but rather a grab-bag of the various types of processing that are considered *not conscious* (Bargh, 1989, 1994, 1996; Logan & Cowan, 1984; Neumann, 1984; Wegner & Bargh, 1997). That is, while there has been consensus over the years as to the qualities of deliberate or controlled processing, different kinds of "not-conscious" processes have been noted and studied. Conscious processing, by all accounts, is serial (sequential) rather than parallel in nature, is limited in the amount of information it can handle at any one time, corresponds roughly to the contents of phenomenal awareness, and is directed by the individual's intentions and goals. The latter quality enables control processing to be flexible and strategic, able to override (nearly always) the usual or habitual response in a situation.

²For some reason, we feel compelled to point out that priming research thus originated at New York University.

And so, if a process or effect was discovered that did not have one or more of these features, it was considered to be "automatic" under the assumption that there were two and only two basic types of information processing: conscious and automatic (see, e.g., Johnson & Hasher, 1987; Posner & Snyder, 1975; Shiffrin & Schneider, 1977). Over the past century of research, however, two distinct strains of not-conscious processing had been discovered and studied. These two separate programs of research have led today to two major types of automaticity: *goal-dependent* and *preconscious*.

Goal-Dependent Automaticity and Skill Acquisition Research

One type of not-conscious processing concerns acquired skills that through a great deal of practice or experience come to be executed very efficiently, needing minimal if any attention or guidance (see Newell & Rosenbloom, 1981; Shiffrin & Schneider, 1977). Examples of such skills are driving and typing, abilities that can operate without conscious guidance once started, but which are nonetheless intentional in that they are require an act of conscious will to begin operation.

Although William James was not fond of the nonconscious as a scientific construct, his concept of *habit* did provide the heritage for modern-day conceptions of automaticity. James (e.g., 1890) placed great importance on habit in daily life, and believed that habits are ingrained by consistent and diligent practice. James' notion that activities frequently and consistently engaged in require less and less conscious effort over time became the foundation of skill acquisition research (see Anderson, 1983; Newell & Rosenbloom, 1981).

For example, Shiffrin and Schneider (1977) proposed that perceptual skills can become automatized over time. They conducted a series of studies in which the participants' task was to detect a single letter or digit target within a rapidly presented array of letters and digits. After thousands of such trials, attention was automatically directed to the target. This pointed to the importance of *frequency* for the development of automaticity. Shiffrin and Schneider (1977) also showed the importance of *consistency*, in that automatic detection capabilities were only achieved when a stimulus was always a target or always a distractor; when the participants' response to the target varied, automatic responses did not develop.

It is important to note that in all of the skill-acquisition research, past and present, there is an underlying assumption that an initial conscious act of will is required to set the effects into motion. One does not drive, or type, or find targets in a perceptual display without having the intention of doing so, regardless of how efficient and automatic the processing is once engaged in the activity. This form of automaticity is called *goal-dependent* (Bargh, 1989) because unlike the other major form (see next section), it requires an initial intention or act of will to put the process into motion.

Preconscious Processing

The New Look was concerned with immediate reactions to a stimulus prior to it reaching conscious awareness. Today, the idea that a substantial amount of information processing occurs immediately upon an environmental event – for instance, the activation of an individual's stereotype of a social group upon the mere presence of a member of that group – has found wide acceptance. But at the time, the New Look's focus on motivational and personality determinants of conscious perceptual thresholds was very controversial. This was due to its notion of perceptual defense which, with its basis in Freudian notions of defense mechanisms, argued that perceptual thresholds were higher for emotionally-threatening stimuli. However, if this were true, it would have violated the ingrained and implicit assumption of the time that perception was a conscious act (see Erdelyi, 1974). The New Look ideas about preconscious analysis were about 25 years ahead of their time, but eventually the assumption that all of perceptual activity is fully conscious was overthrown.

Mainly this occurred through research on selective attention, beginning with Broadbent's (1958) seminal work. Broadbent held that an individual is equipped with an internal, and intentionally operated, selection mechanism that "tunes" attention to focus on certain information in the environment and to disregard other information. But while Broadbent argued for an "early selection" theory of attention – that is, information to be selected is determined very early, prior to a complete analysis of the input for meaning – Treisman (1960) demonstrated that in fact some to-be-ignored contents do in fact receive analysis for meaning, prior to attentional selection. While her participants were very good at ignoring the to-be-unattended ear in a dichotic listening task, in which they were to repeat out loud a story played to one ear but not the other, there nonetheless were times when they would repeat the contents of the

unattended channel. This occurred when the attended story switched to that ear. Thus the idea of pure early-selection was dispelled. Such a theory could not account for the switching of attention to an unattended channel based on the meaning of the information presented there.

After this demonstration that some selection outside of conscious awareness does indeed occur, a lively debate began as to exactly how much. While many argued for a relatively early-selection model, in which only a limited amount of informational input is analyzed for meaning (e.g., Neisser, 1967), others (e.g., Deutsch & Deutsch, 1963) argued for a late-selection, complete analysis model. According to this model, there is a full and complete preconscious analysis of all sensed information for meaning and importance, and information enters consciousness depending on its importance for the individual.

In a historic synthesis of the two positions, Norman (1968) proposed that the extent of preconscious analysis varied, depending on the match between the external information and the readiness or accessibility of internal memory representations relevant to that information. And so cognitive psychology had come full circle back to the discredited ideas of the New Look – which had originally proposed that individual differences in internal states (i.e., due to emotions, needs, and goals) affected perception prior to the attainment of the conscious percept.

Finally, in a very influential paper, Posner and Snyder (1975) put forth a model suggesting that automatic processes at encoding are triggered directly by the presence of the relevant stimulus. However, strategic conscious processes can override automatic ones to determine the response to the stimulus when the responses suggested by the two are incompatible – but only if the conscious process has enough time to develop and attentional capacity to operate. The basic proposals of this model were supported in a series of experimental tests by Neely (1977).

Priming and Automaticity Together

This is the heritage of contemporary priming and automaticity research in social and personality psychology. Priming studies are concerned with the temporary activation states of an individual's mental representations, and how these internal readinesses interact with environmental information to produce perceptions, evaluations, and even motivations and social behavior (see Bargh, 1997). Automaticity

research is conceptually quite similar to priming studies, but generally concerns *chronic* individual differences in mental representations that transcend the current context. Both types of research focus on the accessibility or ease of activation of social knowledge structures, and how these influence psychological phenomena without the individual being aware of or intending such influences.

Moreover, because priming produces for a short time a level of activation and accessibility in a representation that is comparable to that of a long-term, automatic process (Bargh, Bond, Lombardi, & Tota, 1986), priming techniques also have been exploited as a way to experimentally manipulate what are theoretically posited as chronic, automatic effects. (For examples of this use of priming, see Bargh, Raymond, Pryor, & Strack, 1995, Experiment 2; Chen, Shechter, & Chaiken, 1996; Fazio, Sanbonmatsu, Powell, & Kardes, 1986, Experiment 3; Roskos-Ewoldsen & Fazio, 1992). Thus priming techniques can be employed either to research the passive, unintended influences of the current and recent environmental context, or to experimentally simulate automaticity effects.

PRIMING RESEARCH TECHNIQUES

There are a variety of experimental techniques that fall under the general umbrella of *priming* research. *Conceptual priming* involves the activation of mental representations in one context, so that they exert a passive, unintended, and non-aware influence in subsequent unrelated contexts until their activation dissipates. Examples of such research are the many trait concept priming studies in which using the word "honest", for instance, as part of a language test causes one to perceive a subsequent target person as more honest. In this research, the participants' task in processing the concept-relevant information (i.e., the priming task) is not the same – in fact is kept as different as possible – as their task in the subsequent part of the experiment that assesses the priming effect. In this way, the priming effect is shown to be due to the concepts primed (independent of processing goal), and not the priming of a particular mental procedure, which distinguishes this type of priming from the next.

Mindset priming manipulations have the participant actively engage (or read about someone else so engaged) in a goal-directed type of thought in one context, to show that this mindset (Gollwitzer, 1990) – what goal to pursue in the situation – is more likely to operate later in an unrelated context. Thus,

what is primed is a procedure or purposive way of thinking about information or a situation. For example, Wilson and Capitman (1982) had some of their male participants read a "boy meets girl" story in an allegedly unrelated first experimental task, and they smiled more and generally behaved in a more friendly way to a female confederate in the next part of the experiment.

Unlike the other two types of priming studies, *sequential priming* techniques do not examine the residual effects of recent experience. Rather, they test for chronic connections between two representations, across which activation automatically spreads, for example that between an attitude object and its evaluation, or between two different concepts. Sequential priming is therefore the technique of choice for studying the associative *structure* of the mind. The discussion of sequential priming techniques therefore will be postponed until the section on automaticity research, which is also concerned with long-term structural effects.

What all three types of priming have in common is a concern with the *unintended consequences* of an environmental event on subsequent thoughts, feelings, and behavior. They address the residual effects of one's use of a representation in comprehending or acting upon the world, which leaves the primed representation, or any other representation automatically associated with it, active for some time thereafter. During the time it remains active, it exerts a passive effect on the individual, one that he or she is not aware of and does not intend – and is therefore unlikely to control (see Bargh, 1994; Bruner, 1957; Higgins, 1989, 1996).

Conceptual Priming

In conceptual priming, manipulations are used that activate the internal mental representation of interest in a first task, in such a way that the participant does not realize the relation between that activation event and the later influence or use of that representation in an unrelated context. The priming task must use the concept or representation in some way, but not in a way that tips the participant off to the relation between the two tasks. To show it is just the mere activation of the representation that is important, and not its particular use in, say, person perception, tasks have commonly exposed the participant to representation-relevant stimuli (i.e., words or pictures) in an unobtrusive way.

Supraliminal Priming

There are different degrees to which an individual may be aware (or unaware) of the actual stimuli priming a given construct. In supraliminal or "conscious" priming, the participant is exposed to the priming stimuli as part of a conscious task. That is, the individual is fully aware of the priming stimuli itself, but is not aware of some underlying pattern which serves to prime the construct. A very frequently used supraliminal priming technique is the "Scrambled Sentence Test" first devised by Costin (1969) as a clinical projective test but adapted by Srull and Wyer (1979) in their trait construct priming research. An example is given in Table 1. Participants are told that the task is designed to measure their language ability, and they are instructed to make coherent, grammatical sentences out of each string of words. In the course of doing so, they are exposed to some words that are related to the concept the experimenter wishes to prime.

Generally, priming stimuli are selected by consulting a standard thesaurus for close synonyms of the to-be-primed concept. Pretesting can also be used to supplement this set of synonyms if more or varied priming stimuli are needed, by having a separate group of participants rate the degree to which each potential prime is related to the target concept. It is a good idea to use as many different words that are synonyms of the target concept in the Scrambled Sentence Test as possible, because repeating a given word increases the chances that the participant may clue in to the purpose of the task, or at least become consciously aware that the experiment seems to be focusing on that particular concept.³ At the same time, one must be careful not to sacrifice direct activation of just the single concept of import by using only peripherally related primes.

Awareness checks for supraliminal priming tasks. One wants, of course, to have the most powerful manipulation possible, while at the same time not overstepping the line that leads to the participant's awareness. There is no easy rule to achieve the "right" level of subtlety, but we can offer a few guidelines based on experience. One is to engage in extensive debriefing of the participant to ensure he or she is not cognizant of the relation between the priming manipulation and the subsequent

³Note that this is not normally a problem in subliminal priming, in which the same set of words directly related to the primed concept can be repeatedly presented over the course of the priming task (see Bargh & Pietromonaco, 1982).

experimental task. The best way of doing this is through a "funneled debriefing" (see Chartrand & Bargh, 1996; Eagly & Chaiken, 1993). Table 2 gives an example of this technique. Briefly, the idea is to probe in a systematic way for any suspicions or actual knowledge the participant has about the intended effect of the prime on their subsequent performance in the experiment.

In general, if a participant evidences any genuine awareness of a relation between the prime and experimental task, his or her data should not be included in the analyses. By "genuine awareness" we mean any answer in the debriefing which is "in the ballpark" as to what could have affected responses. In our research, we take a conservative stance and err on the side of over-exclusion if there is any doubt.

If an alarmingly high proportion of participants are being excluded for this reason — and those alarms should go off if upwards of 5% or so are showing awareness of the priming influence on their responses — it is likely that even participants who remain in the data set might have had some degree of awareness.

The second tactic that we recommend is to replicate priming effects that are obtained with "conscious" or supraliminal priming techniques (e.g., the Scrambled Sentence task) using subliminal prime presentation instead (see next section). While subliminal priming is a weaker manipulation, obtaining the same significant effect using it goes a long way towards dispelling doubts about the 'demand' or conscious, strategic nature of the obtained priming effects.

Subliminal Priming

Subliminal priming studies in social psychology may be carried out, therefore, not only to demonstrate effects of nonconsciously perceived stimuli, but to conclusively rule out alternative explanations for priming effects. (Discussion of subliminal priming is also relevant to the topic of automaticity, in its sense of processing without awareness; see Bargh, 1994.) That was the reason why Bargh and Pietromonaco performed the first subliminal trait construct priming study in 1982 — to ensure that the original findings of Higgins et al. (1977) and Srull and Wyer (1979, 1980) had not been due to demand or other active strategies on the part of the experimental participants. All of those previous studies had presented the critical primes to participants as part of a first, explicit task. Similarly, Devine's (1989) use of the same procedure to prime

the African-American stereotype was motivated by a wish to eliminate self-presentational strategies on the part of the experimental participants that could mask the true effects of the stereotype.

The mechanics of conducting subliminal priming studies are straightforward, and hinge on three principles: (1) very brief presentation of the prime, (2) its immediate *masking* by another stimulus, and (3) appropriate awareness checks.

Brevity of presentation translates into the amount of internal activation of the corresponding representation. Roughly speaking, the amount of internal activation is given by the formula $D \times I = A$, where D is the duration of the stimulus, I is its intensity, and A is the amount of activation. Using a tachistoscope, as was used in many of the New Look and perceptual microgenesis studies, one could vary the illumination level of the stimulus, or use gelatin filters (similar to the effect of sunglasses) to make the stimulus harder to see. But the great majority of subliminal presentations in modern research accomplish their purpose by varying the duration, not the intensity, of the stimulus.

How long can a stimulus be presented and still be subliminal? Given that recognition thresholds are often if not usually measured in terms of millisecond duration, and that there are individual differences in these thresholds (see Bargh et al., 1988; Greenwald, Klinger, & Liu, 1989), no single answer can be given. Establishing individual thresholds is a laborious and time consuming process (e.g., a half hour of dark adaptation; see Greenwald et al., 1989), so the practical solution is to use a duration brief enough for most if not all participants, and to conduct a conservative awareness check on these same participants (more on this below).

The appropriate duration depends on whether the stimulus will be masked, and whether it is presented to the participant's *foveal* or *parafoveal* visual field. Roughly speaking, foveal processing is given to information in the center or focus of conscious visual attention, and parafoveal processing is of information in the fringe or periphery of the attended region. The foveal processing area extends from 0 to 2 degrees of visual angle from the focal point of attention (see Figure 1). In experiments involving a tachistoscope or computer screen, foveal presentation is accomplished through presenting a "fixation point" (such as an asterisk) and the critical stimulus at the same position.

The parafoveal visual field extends beyond the foveal, from about 2 to 6 degrees of visual angle. Determining the parafoveal area of computer display screens involves taking into account the distance between the participant's eyes and the screen; the farther away the participant is seated from the screen the greater the area on the screen that falls in the foveal region (see Figure 2 and Bargh et al., 1986, for details on calculating the visual angle).

Information presented in the parafoveal region does not reach conscious awareness, at least as concerns its meaning or identity. One does become aware of movement and changes in this region, which automatically attract attention. However, such information is processed subconsciously to some extent. One can therefore "get away with" longer presentation durations with parafoveal compared to foveal presentation. The study of parafoveal processing has been a major topic in research on reading; specifically on one's ability to anticipate or "look ahead" in order to facilitate the conscious processing of the material (see Raynor, 1978).

Masking. It is usually not sufficient to present a prime briefly and then remove it from the display. This is because the *effective* duration of the stimulus is longer, for two reasons. First, the decay rate of the medium in which the stimulus is electronically presented (this is not a problem for tachistoscopic display) is greater than zero. Older monitors (ca. 1980s) used a phosphor medium that sometimes took so long to decay that you could watch it happen. More modern computer monitors have much faster decay rates, but it is important to look into this specification before purchasing equipment. The best of today's monitors have such fast decay rates that it is no longer a problem, at least for the kind of subliminal studies usually done in social psychology.

But even if you are using a tachistoscope or the best computer monitor on the market, you still need to mask the stimulus. This brings us to the second reason why a stimulus duration could be longer than intended (and attain conscious awareness): because it tends to persist in the participant's visual iconic memory store for a time after it has physically disappeared from the display (see Sperling, 1960, for the first demonstration of the existence of visual iconic storage). To erase or overwrite the visual buffer, so that the effective presentation duration of the prime is the same as its actual duration on the screen, a pattern mask should be presented at the same location, overwriting the prime on the display, and for as long as – and

preferably longer than – the prime had been presented (Marcel, 1983; Turvey, 1973).

A pattern mask contains the same features as does the prime so that the same mental feature detectors are used in perceiving it. However, so as not to interfere with the effect of the prime, the pattern mask should not correspond to any higher level meaning. Thus, for example, the primes in the Bargh et al. (1986) study were all words, and so the masking string ("XQFBZRMQWGBX") was made up of the same features – that is, letters – but was not itself a word. In this way the same feature detectors are employed for prime and mask, disrupting the visual iconic storage.

With immediate pattern masking, the prime can be presented outside of awareness at durations of 5 msec or below for foveally presented faces (Bargh et al., 1996, Experiment 3; Edwards, 1990), and schematic line-art renderings (i.e., cartoon-like drawings) of faces (Niedenthal, 1990).⁴ When parafoveal presentation is used instead of foveal, longer durations can be used: 60 msec in Bargh et al. (1986), 125 msec in Erdley and D'Agostino (1988), 90 msec in Bargh et al. (1995, Experiment 1), and 60 msec in Chartrand and Bargh (1996, Experiment 2).⁵

With parafoveal presentation it is important to ensure that the prime is really presented parafoveally – that is, that the participant's visual focus is on the desired fixation point. Only then can one be entirely sure that the prime was parafoveally and not foveally presented. For instance, if the parafoveal prime is always presented at the same point in time in a trial (say, 1 second after a warning signal), it can easily be anticipated, and the participant's attention can move away from the instructed fixation point to the location of the flash (making it phenomenally foveal regardless

⁴Perdue, Dovidio, Gurtman, and Tyler (1990) presented words (related to the group concepts of *us* and *them*) foveally for 55 msec, with immediate pattern masking, but as they did not run awareness checks (basing claims of subliminality instead on the reports of pretest participants), one should be extremely cautious in the use of such a lengthy foveal presentation time. Seamon, Brody, and Kauff (1983), for example, found greater than chance recognition of polygons presented foveally (and pattern masked) at 5 msec.

⁵When using computer-generated displays and monitors, the minimum presentation time is constrained by the monitor hardware – specifically, the screen refresh rate. For example, a 60 Hz monitor updates its display 60 times a second, or once every 16.7 milliseconds; a 70 Hz monitor every 1/70th or 14.3 milliseconds. Even if the program controlling the display instructs that a stimulus be displayed for a shorter time than this, the stimulus will nonetheless be displayed for the full duration of the screen refresh cycle.

of the experimenter's intention).

To avoid that possibility, we have often inserted a random delay of from 2 to 7 seconds between the trial warning signal and the presentation of the prime (see Bargh & Pietromonaco, 1982; Bargh et al., 1986; Chartrand & Bargh, 1996). In addition, the prime was presented in one of four possible locations ("quadrants") on the screen (all in the parafoveal region). Which one of these was used for a given trial was determined randomly by the computer, thus minimizing the possibility of anticipations by the participant.

Could the participant move his or her eyes quickly enough after the presentation of the prime to "catch" it before it is masked, and thereby consciously see its content? The answer is no, as long as the parafoveal presentation is short enough. The normal speed of saccadic jumps of the eye from one location to another is about 220 msec, by which time the presented prime and mask are long gone from the display. (There is some controversy over the existence of even faster saccadic jumps of 100 msec, called "express saccades" [Fischer & Weber, 1993], but if the parafoveal presentation is 60 msec or so even these could not get there in time.)

One way to insure that the participant's attention is focused on the fixation point at the time of the parafoveal "flash" is to give him or her some task to perform involving stimuli presented at the fixation point. For instance, the participant could be asked to repeat out loud each of a series of digits presented at the fixation point, with the experimenter keeping track of correct performance. The prime could be presented immediately following the presentation of the final digit so that if the participant reported it correctly, visual attention could be safely assumed to not have been at the presentation location. (One could go further and vary the number of digits presented on each trial, and in this way prevent the participant from anticipating the moment of prime presentation.)

Awareness checks for subliminal priming tasks. With subliminal priming, one should probe for actual awareness of the relation between the priming and experimental tasks, just as with supraliminal priming. It is always possible for the participant to "get lucky" and happen to be looking right at the prime location at the moment it was presented, all of the experimenter's precautions notwithstanding. And — it only takes conscious awareness of one prime to possibly make the participant aware of the nature of

the priming stimuli, and consequently raise the specter of demand effects.

As an awareness check, the experimenter could follow up the experimental trials with a short re-presentation of some of the original priming trials. The participant should be informed this time that words (or pictures) are being presented, and to try to guess what they are. If the participant is not able to guess any of the words or identify the gist of the pictorial content, it is safe to say that subliminal presentation has been achieved. An even more conservative test would be to give participants the correct answer along with one or more distractor items prior to each trial of the awareness check, and compare performance to that of a control group to which no actual primes are presented (Bargh et al., 1986).

Note in this regard that comparing performance to chance levels (e.g., 50% on two item tests) is not an appropriate awareness check, because the particular distractors that are used can vary in how likely they are to be chosen given no primes. Factors such as word frequency or relevance to psychological issues (e.g., personality trait terms versus vegetable names as distractors) play a role in the frequency with which both distractors and target primes are chosen (see Fowler, Wolford, Slade, & Tassinary, 1981). Thus comparisons need to be made between the frequency with which the distractors are chosen in the prime and a no-prime control condition.

Our recommendation is to forego giving the participant options from which to choose, and to base judgments of awareness on his or her ability to consciously report the prime stimulus after each trial of the awareness check task. Better than chance performance in selecting the correct item from a set of options could come from actual awareness, but it also could be the result of priming itself! (Indeed, such a result might well be expected on theoretical grounds.) If one instead uses *any* effect of the prime on task performance as the definition of awareness, subliminal effects are defined out of existence (see, e.g., Holender, 1986) — and this does not seem a very interesting or productive route to take.

Supraliminal and Subliminal Priming Compared

This brings us to an important point about the role of awareness in priming effects. The same effects have been repeatedly obtained with subliminal and supraliminal priming manipulations alike: assimilation of ambiguous but relevant input into the primed category, or activation of the primed goal. For

PRIMING AND AUTOMATICITY RESEARCH

example, in the subliminal priming studies described above, the same assimilative priming effect was obtained as in the original Higgins et al. (1977) and Srull and Wyer (1979) studies that used supraliminal primes. Thus, awareness of the priming stimuli's presentation does not matter for the obtained effect.

However, awareness of the potential effect or influence of the priming events *does* matter. This may specifically become an issue when using supraliminal priming procedures. If the primes are very extreme exemplars of the category (e.g., Hitler and Dracula as primes for "hostile"; see Herr, Sherman, & Fazio, 1984), they are especially memorable and likely to be used as a conscious standard of comparison subsequently. Target person Donald's refusal to pay his rent pales in comparison as an example of hostile behavior next to the exploits of Torquemada: if one has just read about the horrors of the Spanish Inquisition, one would probably see Donald as less, not more hostile than otherwise. Strack and Hannover (1996) provide a thorough analysis of when such "contrast" effects are to be expected. The most important factor seems to be whether the priming event is still in conscious awareness (or working memory) at the later, critical moment (see Lombardi, Higgins, & Bargh, 1987; Newman & Uleman, 1990).

So, if a person is aware of the relevance of the priming event to the later perception or judgment, there is an adjustment away from the presumed effect of that event (i.e., the person's "theory" of how they would have been influenced; see Wegener & Petty, 1995). But in the usual case, in which one is not aware of the potential influence, bias in the direction of the primed representation occurs.

Clearly, then, what matters for the occurrence of unintended effects of the environment on one's thought, feeling, and behavior is not the lack of awareness of the *occurrence* of the event – which is how cognitive psychologists typically define unconscious influences; see Greenwald (1992; Greenwald, Draine, & Abrams, 1996; Shevlin, 1992) – but instead a lack of awareness of the potential *influence* of that event. One can be consciously aware of the event and still have it affect or even control one's thought or behavior. (For the vigorous historical debate as to one's degree of awareness of mental processes more generally, see Ericsson & Simon, 1980, and Nisbett & Wilson, 1977.)

Strength of Priming Manipulations

In general, the more priming stimuli presented

to the participant, the stronger the obtained priming effects. Srull and Wyer (1979) varied both the number of items in the Scrambled Sentence Test (30 or 60) and the proportion of the items containing trait-relevant primes (20% or 80%). Both factors produced significant main effects, meaning that the more total primes and the greater the concentration of relevant primes within the task, the stronger were the priming effects on impressions.

As a general rule, Scrambled Sentence Test or other "conscious" priming tasks – that is, tasks in which the individual is aware of the priming material – produce stronger priming effects than does subliminal priming. Activation from a conscious, intentional processing of the primes is stronger than subconscious activation – in the same way that increasing the brightness or duration of a stimulus on a tachistoscope eventually raises it from being invisible to visible. The stronger the activation of a concept, the greater its accessibility and likelihood of subsequent use (Higgins & King, 1981).

Moreover, the stronger the priming manipulation, the longer the priming effect lasts. Higgins et al. (1985) explicitly tested a "synapse" model of concept accessibility in which the frequency of priming was pitted against recency of priming. Stimuli related to two different trait constructs (e.g., *adventurous* and *reckless*) were presented in a Scrambled Sentence Test, but with one trait primed more frequently during the course of the task, and the other primed more recently (i.e., on the final trial). Then, in the ostensibly unrelated task that followed, participants read about a target person who behaved in a way applicable to both primed concepts (e.g., sailing alone across the Atlantic). Participants' impressions of the target person were more consistent with the evaluative implications of the recently primed trait if they were asked their opinion right after the priming task, but more consistent with the evaluative implications of the frequently primed trait if asked a few minutes later.

However, in the quest for a powerful priming effect, one must be careful not to overdo it. Great care should be taken when designing and conducting priming research in order to rule out active effects of the priming manipulations – the most notorious of these being demand effects. A manipulation that is too heavy-handed – such as having every one of the 20 items in a Scrambled Sentence Test contain a synonym of the trait construct being primed – is likely to tip off the participant as to the nature of the study, especially when they see the "Donald" story served up

next in which the protagonist behaves somewhat in line with that trait.

Beyond Perception: Goal and Behavior Priming

A fairly recent development in priming research is the opening up of the range of psychological phenomena that can be primed. For many years priming research focused exclusively on effects in perception and impression formation (see reviews in Bargh, 1994; Higgins, 1989; Wyer & Srull, 1989). While some studies did employ a dependent variable that was not a judgment – for example, the participants' behavior toward another person or toward an attitude object (see Carver et al., 1983; Fazio, Chen, McDonel, & Sherman, 1982; Herr, 1986; Neuberg, 1988), it was a priming effect on an evaluation or judgment that mediated the behavioral effect.

Recently it has been shown that the same priming manipulations used in the past to produce perceptual effects, such as the Scrambled Sentence Test, produce behavioral or motivational effects as well, if that kind of dependent measure is employed instead. That is, it is possible to prime a behavioral tendency or prime a particular goal via the same manipulation (supra- or subliminal) originally employed to produce perceptual effects. For example, Bargh et al. (1996, Experiment 1) used a Scrambled Sentence Test to activate the concept of rudeness or politeness, and then waited to see if the participant would interrupt a conversation in order to get his or her next task from the experimenter. Those primed with rude stimuli were far more likely to interrupt (63%) than non-primed participants (38%) and those primed with politeness interrupted the least often of all (17%). Importantly, this effect was not mediated by the participants' impressions of the experimenter, so it appeared to be a direct effect of priming on behavioral tendencies (as predicted from the theoretical position that there is a direct passive effect of perception on action; see especially Prinz, 1990, in press).

Motivations and goals can also be primed. Bargh and Gollwitzer (1994) report several experiments in which achievement or affiliation motives were activated by having participants first perform a "word search" task. Embedded in a matrix of letters were words synonymous with one or the other motivation. Those primed with achievement worked harder and found more words in subsequent word search tasks compared to participants primed with affiliation, who were more concerned with

interacting with the confederate than with working on the task.

The purpose of the Chartrand and Bargh (1996) studies was to show that primed information-processing goals operated the same way as did consciously and intentionally activated goals. Our first experiment used a Scrambled Sentence Test to prime either the goal of forming an impression or of memorization (shown in Table 1). Next, in an ostensibly unrelated second experiment, participants were presented with the set of social behaviors used in Hamilton, Katz, and Leirer (1980b). We obtained the same results as in the Hamilton et al. (1980b) study – higher free recall of the behaviors and a greater degree of thematic organization of them in memory in the impression than in the memory condition – even though we primed those goals instead of giving them to participants directly through experimental instructions. And in our second experiment, we replicated previous findings of on-line impression formation (Bargh & Thein, 1985; Hastie & Park, 1986) using subliminal priming of the impression goal instead of explicit conscious instructions to the participant to form an impression.

What Have We Been Priming All These Years?

It is noteworthy that the same priming methods – such as the Scrambled Sentence Test and subliminal prime presentation – produce motivational and behavioral as well as perceptual effects. The inescapable conclusion from this fact is that in a given experiment, a priming manipulation simultaneously produces *all* of these various effects. Just because the dependent variable of interest in a given study is, say, impressions of a target person, this does not mean that the only effect of the priming manipulation was on the participants' social perception. If the experimenter had instead placed the participant in a situation in which he or she could behave in line with the primed construct, behavioral effects would have been obtained instead.

Priming effects, along with automaticity effects, occur and operate in parallel. Priming manipulations have more effects on the participants (and on people in real life) than happen to be measured by the experimenter. It is in our view one very important direction for priming and automaticity research in the future to sort out how these various simultaneous processes interact with one another (for an example, see Moskowitz, Wasel, Gollwitzer, & Schaal, 1997).

Mindset Priming

Mindset priming studies, reviewed in this section, also prime motivations or processing goals but do so by having the participant first engage in that goal or intentionally use the mental procedure in question. Because the priming involves active and intentional use of the procedure, and not just the passive activation of the goal concept, we consider mindset priming to be a different variety than conceptual priming. Instead, mindset priming is characterized better as a carry-over of an intentionally pursued goal or mental procedure to a new context. An act of conscious will on the part of the participant is required, unlike in conceptual priming.

As a result, there is a greater role played by intention and awareness in mindset priming, which makes studies using this technique more susceptible to demand effects. Nevertheless, it is sometimes more appropriate to use a "carry-over" priming paradigm than a conceptual one. For instance, if the concept to be primed is too abstract or too procedural to prime with a single word in a scrambled sentence task or subliminal priming procedure, it might be more reasonable to use a carry-over priming task. Moreover, it is a legitimate matter of interest whether intentional goal pursuits in one context influence the individual's decisions and behavior in subsequent contexts, without their awareness (or choosing) of this goal at the later point in time.

The original study of this kind was performed by Gollwitzer, Heckhausen, and Steller (1990). The participant was instructed to think about a personal problem in one of two ways: either to dwell on the pros and cons of a specific way to solve the problem (inducing a *deliberative* mindset), or to generate a specific detailed plan to accomplish an important personal life-project (inducing an *implemental* mindset). (Control condition participants merely looked at a book of photographs during the same time period.) In the ostensibly unrelated second experiment, participants were given the first few lines of several novel "fairy tales" and were instructed to complete each tale. They could complete the story any way they liked, but as predicted, those who had previously been given an implemental (action-oriented) mindset were more likely than the other participants to continue the story with what the protagonist actually *did* in order to accomplish a chosen goal, whereas those participants previously in a deliberative mindset more often wrote endings in which the protagonist considered and chose between various action alternatives. These findings suggested

that the goal or mindset used in the "first experiment" continued to be active and operate in the second task, without participants being aware of or intentionally choosing this mode of thought while writing the story endings.

A second example of mindset priming comes from research by Bator and Cialdini (1995; see Cialdini, 1994). In a first experiment, motivations to hold consistent beliefs (i.e., cognitive consistency) were primed in some participants. This was done in the following manner. Participants were told that they would be interacting with another person, and then read an essay purportedly written by that person. The content of this essay either indicated that the other person very much valued consistency in beliefs and behavior, or it did not indicate this. Next, in what was presented as an unrelated experiment, all participants were asked to write an essay in favor of having comprehensive examinations instituted as a graduation requirement -- something nearly all of these college students personally opposed. Participants wrote this counterattitudinal essay either under free choice (i.e., they were asked to by the experimenter but could ostensibly say no) or no choice (i.e., they were instructed to by the experimenter) conditions, following which they were asked for their own positions on the issue.

According to cognitive dissonance theory (e.g., Wicklund & Brehm, 1976), writing counterattitudinal essays under free choice conditions should cause the participant to become more favorable towards the issue, compared to participants who felt they had no choice in writing the essay. However, Bator and Cialdini obtained this effect only for those participants whose consistency motivation had been primed. Participants in the control (not primed) condition held the same final position on the comprehensive exam issue regardless of whether they had written the essay under free choice or no choice conditions.

Other research programs have recently used the unrelated task paradigm to pre-activate specific motivations. In an interesting variant of the mindset priming technique, Chaiken and her colleagues (Chaiken, Giner-Sorolla, & Chen, 1996; Chen et al., 1996) first gave their experimental participants a scenario to read in which the target person was portrayed either as being concerned with accurately understanding what was going on, or with making a good first impression on another person. This was to manipulate whether an *accuracy* or an *impression-management* goal was activated. In the apparently

unrelated second experiment, participants were given an attitude issue (e.g., gun control) that they would be discussing with another participant, who was described either as holding a pro or a con position on that issue.

Participants then read an essay containing arguments on both sides, and while reading it they wrote down any reactions they had to the essay. Finally, participants gave their own attitude about the issue. As predicted, the attitudes of participants for whom the impression motive had been primed were closer to that of the other person they had expected to meet, compared to the expressed positions of the accuracy-motive primed participants.

To us, this technique – in which participants read about and so vicariously experience the story protagonist's goals and purposes – represents a mixture of the more passive or conceptual goal priming technique and the more active, mindset priming in which the participant him or herself has pursued in the particular goal being studied. On the one hand, it seems that something more is occurring in this priming technique than the passive activation of the goal, because the participant is reading about and perceiving a target person actively pursuing that goal – and yet because the participant is not explicitly engaging in the relevant intention or act of will, it seems less active than the Gollwitzer et al. mindset priming study. While we cannot offer a definitive solution at this very early stage of motivational priming research, the Chaiken et al. priming study does show that our present distinction between conceptual and mindset priming is fuzzier than we would wish, and should be seen as more tentative than definitive.⁶

Unwanted Effects of Priming

Priming is an experimental sword that cuts both ways. That is to say, a participants' recent experience in an experimental setting will potentially affect his or her subsequent responses whether or not such an effect was intended by the experimenter. Having participants complete questionnaires prior to another dependent measure can be a major source of unwanted priming effects (i.e., unless of course the experimenter has planned for and wants this influence). This is because in the course of the questionnaire the participant will consider and use concepts that then become more accessible and likely

⁶More interesting to us about the Chaiken et al. study than where it fits into our particular classification scheme is its implications for how an individual's own motives might be automatically triggered by those he or she is currently perceiving in another person.

to be used, if relevant, in subsequent experimental tasks. This is especially a problem if the experimenter wishes to draw conclusions about the chronic or long-term nature of the effects found in the latter tasks, because the temporarily primed state of the influential concepts might have produced the effects instead.

This has now been demonstrated in several studies. When Skelton and Strohmets (1990) had some participants first rate a series of words on their health connotations, those participants subsequently reported having a greater number of health problems as measured by symptom check lists. Marks, Sinclair, and Wellens (1991) gave their depressed and nondepressed participants the Beck Depression Inventory (BDI) at the beginning of the experimental session, and thereby produced different self-judgments compared to those of participants who had not earlier completed the BDI.

Any good experimental design is informed by a *task analysis* in which the experimenter carefully considers how the various manipulations and tasks will affect the psychological state of the participant. Our advice is to include in such task analyses a consideration of how tasks positioned earlier in the experimental session could possibly, through conceptual or mind-set priming, influence dependent measures positioned later in the session. A failure to do this yourself at the design stage runs the risk of having a careful journal reviewer do it for you later on, when it is too late.

Demand Characteristics and Mindset Priming

Priming manipulations seek to activate concepts in one context to study the passive effects of this activation in a subsequent task. Conceptual priming produces this activation with a first task that is as different from the experimental task as possible, to show that it is the mere activation of the concept – not the source of or reason for the activation⁷ – that matters. Mindset priming, however, involves the active use of a certain way or thinking (at least, vicariously) by the participant in the "first experiment", that is then more likely than otherwise to be employed in the second task.

Because of this, one has to be much more worried about experimental demand as an explanation

⁷In fact, if participants are aware of the source or reason for activation when performing the second task, and believe it has an unwanted influence, they may correct or overcorrect for that influence.

for mindset than for conceptual priming results. The skeptic could argue that by being told to deal with information in one way in the first task by the experimenter, the participant assumes that this is what he or she is supposed to do with the information presented in the second task. Extra care should be taken, therefore, to camouflage the relation between the two tasks as much as possible (for example, by using different rooms and experimenters for them), and to probe carefully for awareness of the relation between the two tasks (see Table 2).

AUTOMATICITY RESEARCH TECHNIQUES

As discussed in the History of Automaticity section, there never was such a thing as a single type of processing, called "automatic", that could be studied with just a single paradigm or methodology. Instead, different paradigms and tests have evolved to study the separate qualities of the not-conscious processes that are grouped under the umbrella category of "automaticity." These separate qualities are (a) whether or not the individual is *aware* of the operation of the process, (b) whether or not the process is *efficient*, (c) whether or not it is *unintentional*, and (d) whether or not the individual can *control* the process. While tests of awareness of a process have already been discussed in the Subliminal Priming section (see also Murphy, Monahan, & Zajonc, 1995; Murphy & Zajonc, 1993), there are distinct methods of testing for the presence of each of the other three qualities of automaticity, to which we now turn.

Efficiency

Efficiency in processing is important to study because there are usually many demands on our limited attention, or working memory, at any given moment. Processes that do not require much if any conscious attention to operate will therefore have an advantage under these busy circumstances. They will occur more consistently over time in a given situation and constitute the default set of reactions to most occasions (Bargh, 1997; Brewer, 1988; Fiske & Neuberg, 1990; Gilbert & Osborne, 1989; Gilbert, Pelham, & Krull, 1988; Rothbart, 1981). Therefore, it is important for us as social psychologists, who are in the business of studying the general and typical reactions to situations, to study the efficiency of any process on which we are focused. As Langer (1978) noted two decades ago, we as researchers are not on sure footing when we generalize to the noisy real world the results of laboratory studies in which our participants are given plenty of time and nothing else

to do while the critical phenomenon is being scrutinized.

Contemporary models of stereotyping (e.g., Devine, 1989), causal attribution (e.g., Gilbert, 1989; Trope, 1986), and impression formation (e.g., Bargh & Thein, 1985; Brewer, 1988; Fiske & Neuberg, 1990) posit two stages of processing. One is the default, and is described as very efficient; the second stage is more effortful and can only occur if the person has the *time, attention, and motivation* to use them. We will leave a consideration of the motivational variable to the next section on *unintentional* processing. Efficiency *per se* allows a process to operate in both of two "real world" conditions of information overload: when there is no time to consider and integrate the various available sources of information (such as a rapid stream of behavior, emotional reactions, and so forth during impression formation), and when one's current goals and purposes take attention away from what is going on in the environment.

The attentional demands made by a mental process can be measured directly, typically through reaction time techniques, or the attentional demands of a task can be manipulated to assess if performance is affected. Either method can yield information about the efficiency of the underlying process – its ability to operate under conditions of scarce attentional resources.

Measurement of Efficiency

It is possible to measure the efficiency of a mental process in terms of how much time a person requires to engage in it. Smith (e.g., 1994) and his colleagues have performed a series of studies demonstrating the development of procedural automaticity, in the domain of social judgments. In their paradigm, participants judge whether each of a series of behaviors is or is not an instance of a particular personality trait. The speed with which this yes-no decision is made is measured (in milliseconds). It is shown that the time to make these trait categorizations of behaviors decreases with practice, demonstrating an increase in procedural efficiency or automaticity. This proceduralization has two components: a general component in that judging behaviors with regard to a particular trait (e.g., kindness) becomes fast even with novel behaviors (not judged previously), and a specific component in that the same behavior judged in terms of the same trait is done still more efficiently (Smith, Branscombe,

& Bormann, 1988; Smith & Lerner, 1986; Smith, Stewart, & Buttram, 1992). The speed-up with practice was also found to follow the same inverse power function that characterized non-social mental process proceduralization (e.g., Anderson, 1982).

While it is true that the more efficient a mental process, the less time it requires to run to completion (because conscious attention can only be deployed over time; Logan, 1980), the converse does not follow. That is, one cannot directly infer from the amount of time participants take to make a judgment or decision, for example, how efficient or automatic it is. This is because other factors influence and contribute to response times besides the procedural efficiency of an underlying process – most notably, strategic self-presentation. We treat this issue in more detail later (see “Some issues regarding the use of reaction times as a dependent variable”). The research of Smith and colleagues is a good example of a paradigm in which one is able to draw conclusions about underlying procedural efficiency from raw response times, because the same behaviors are being judged by the same participants repeatedly, in a within-subjects design. Thus, other influences on response times – such as how long it takes the participant to read the behavior – are held constant across trials. Moreover, because the participant is not making self-referential decisions about the behaviors, no self-presentational strategy is likely to be operative.

An interesting variant of measuring efficiency through response times can be found in the work by Macrae and his colleagues (e.g., Macrae, Milne, & Bodenhausen, 1994), on the automaticity of stereotype activation. Instead of measuring latencies in the primary task given participants, as in the research by Smith and colleagues, these researchers made use of a dual task procedure to measure response times to a secondary task. Participants were instructed to monitor a tape-recorded informational passage about Indonesia at the same time as viewing information on a computer screen about a target individual, and forming an impression of him. Some participants were given a stereotypic label (e.g., “skinhead”) about the target. The interesting twist on the usual dual task paradigm was that it was performance on the *secondary* task that was the dependent variable of interest. It was found that performance on the prose-monitoring task, as tapped by later memory for it, was better if stereotype relevant information had been presented in the course of the impression formation task. This confirmed the authors’ hypothesis about the efficiency with which stereotypes process relevant information.

Manipulation of Attentional Demands

One can also assess efficiency of a process by manipulating the attentional demands of a task, to see if this changes task performance. To the extent it does, attention is needed for the task; to the extent it does not, the process is unaffected by attentional shortage and is thus quite efficient. Accordingly, laboratory manipulations of these conditions either present information very rapidly (information overload) or give the participant a secondary task to “load” attentional capacity (what Gilbert et al., 1988, called “cognitive busyness”).

As an example, Bargh and Thein (1985) conducted a person memory study in which a series of 24 behaviors related to the trait of honesty (either honest, dishonest, or neutral behaviors as developed by Hastie and Kumar, 1979) was presented one at a time on a computer screen, and participants were instructed to form an impression of the target person who had performed these behaviors. In one condition, participants could read each behavior at their leisure, pressing the space bar to move on to the next behavior. (This technique had the additional advantage of allowing us to measure how much attention and consideration were given to the various types of information, as operationalized by looking time; see also Fiske, 1980.) But in the rapid-paced condition, each behavior was presented for only one second, with a one second pause before the next behavior came on the screen. This was just enough time for the participant to read each behavior one time through, preventing any further conscious deliberation about a given piece of behavioral information, or its integration with others to form a coherent impression on-line. Results confirmed that this manipulation prevented participants from forming an impression on-line (at the time of reading the behaviors), forcing them to do so only later, based on those behaviors they could recall.

Another type of efficiency manipulation is the *dual-task paradigm*. This involves giving the participant a second task to do at the same time as the experimental task, such as holding a number or word in memory during a trial. One such study compared the automaticity of the self-concept in depressed and nondepressed people, and employed a memory load task to do so (Bargh & Tota, 1988). The main experimental task required participants to answer yes or no as quickly as possible, indicating whether each of a series of positive and negative adjectives described themselves (or, on other trials, described the average other person). Half of the

participants were required to hold a six digit number in memory during each trial, with a different number presented each time. The number to remember appeared on the computer screen first, then the referent of the judgment task for that trial (i.e., self or other), and then the adjective. After the participant had answered by pressing the 'yes' or 'no' key (recording the response latency in milliseconds on each trial), a message appeared on the screen asking them to repeat the six digit string out loud. The indication of automaticity, in the efficiency sense of the term, was the degree to which this second, attention-demanding task caused judgment latencies to increase. Results confirmed the predicted differences in the positivity/negativity of the self concept that becomes active automatically in depressives versus nondepressives.

Gilbert and Osborne (1989) used a variation of the memory-load technique that has become a popular methodology because of its simplicity and effectiveness (e.g., Macrae, Hewstone, & Griffiths, 1993; Wegner & Erber, 1992). They gave participants a single eight-digit number to remember throughout the entire time that the critical person information was presented (via a videotape) and only after all of the information had been presented did they ask participants to repeat the number back. They found predicted differences in attributions and judgments as a function of this 'cognitive busyness' manipulation; the memory load prevented participants from being able to take situational influences into account in their behavioral attributions. Thus participants were more likely to make dispositional attributions under memory load even when clear situational forces were operating to constrain or shape behavior.

It is extremely important when conducting dual-task studies of this sort to make sure of two things. First, the "load" task must be sufficiently attention demanding that little attention remains with which to perform the primary task. Imagine, for example, if in the above studies participants had been given a one or two digit number to remember instead of a six or eight digit number. Judgment latencies, or the type of attribution made across all experimental conditions would likely not be any different from the non-load conditions, but it would be erroneous to conclude from this that making judgments never requires any attention, or that situational attributions are made automatically. We would have the usual interpretational problem of null results. Thus it is best to include in a design conditions under which one does expect the memory load to have an effect, so that one is confident that the load was sufficiently strong to

affect the dependent variables in conditions where it is theoretically expected to do so, while not affecting them in the conditions where one's theory predicts relatively attention-free task performance.

One difficulty with having participants remember the same digit string throughout the experiment is that they *learn* it; that is, they store it in long-term memory, so that they may not need to keep rehearsing it in short-term memory. If a participant successfully learns the string -- and in the Gilbert and other studies using this procedure the participant is given a minute or so before the experimental task starts to rehearse the number -- then clearly the demands on his or her attention capacity would not have increased to any significant degree.

To show that the load manipulation is strong enough, it should be shown independently in a manipulation check to be of sufficient difficulty that participants do not perform it perfectly. In other words, it is good to show that they make errors in reporting the material they were to hold in memory (if that is their secondary task). But if they make too many errors, one can't be sure if they were trying hard enough to perform that secondary task. One strategy the participant might take for coping with the attention load situation might be to disregard one of the two tasks and focus on one or the other exclusively, to the detriment of performance on the other. If the participant adopts this strategy, nothing can be concluded about the attention demands of the primary task.

And so we want the participant to make some errors, but not too many. The solution to this problem adopted by Gilbert et al. (1988) and Gilbert and Hixon (1991) was to omit data from participants if they did not report at least half of the digit string correctly. An alternative is to include, as either a between-subjects (separate set of participants) or within-subjects (additional repeated measure on the same participants) control condition, an even stronger load manipulation. If this additional condition produces the same results as the original load condition, then the latter was most likely completely loading the participants' working memory; if the results differ, then the original load manipulation was not completely using available attentional resources.

It is also possible to test out one's load manipulation through a pretest in which participants are given a task or manipulation known to require conscious effort; the no-load condition should replicate previous findings on this task but the load

manipulation should knock out this effect. This load manipulation check technique was employed by Moskowitz et al. (1997) using outcome dependency as the test manipulation; the load effect successfully knocked out the effect of outcome dependency to increase effortful scrutiny of the target person.

In dual task paradigms, it is important that the participant consider the experimental task to be the primary one – that is, the more important of the two (see Kantowitz, 1974). In order to assess the attentional demands of a primary task, everything should be kept as similar as possible about that task in the load and non-load conditions other than the load itself. If in the load condition the participant believes the primary task to not be as important, and so is not as motivated to perform it compared to participants in the load condition, more than just the attention demands have changed to potentially affect the dependent measures. Thus participants should not be told that the tasks are equally important but instead that – although it is important for them to perform both tasks, not just one or the other – the focal (judgment, attribution, etc.) task is the crucial one for the experiment.

An interesting variant of the memory load procedure was introduced by Tice, Butler, Muraven, and Stillwell (1995). They were interested in the relative automaticity of self-presentational strategies to friends versus to strangers. The content of self-presentations to friends was found to be more modest than those to strangers. But the automaticity of these self-presentational strategies was assessed by the participants' subsequent recall of the interaction. The authors reasoned that the more that attention is focused inward, on one's own interaction performance, the less should be available for external events. Consequently, one's later memory for those events will be poorer. (This phenomenon used to be known as the "next-in-line effect;" see Brenner, 1973). Tice et al. (1995) used this fact to measure the ease or relative automaticity of the different self-presentational strategies. As predicted, when participants were instructed to engage in their natural tendencies – to be modest with friends and self-enhancing with strangers – their later recall of the interaction was better than if they had been instructed to engage in the contrary strategy (i.e., self-enhancement with friends, and modesty with strangers).

Unintended Processing Effects

A major source of unintended effects on

thinking, feeling, and doing is automatic associative connections in memory. If the (intended or unintended) activation of representation "A" then proceeds to activate representation "B" automatically, without any conscious intent or awareness involved, this latter representation can have an unintended effect on judgments, evaluations, and behavior. For example, Devine (1989) designed her study to show that (white) participants "went beyond the information given" in their stereotypic assumptions by priming them with some aspects of the African-American stereotype, but not directly with "hostility" – also an element of that stereotype. The priming manipulation nevertheless did influence subsequent judgments about a target person's hostility, an effect that could only have occurred if hostility had been activated unintentionally because of the automatic spread of activation within the stereotype. Bargh et al. (1995) showed how the activation of the concept of power spread automatically to the concept of sex for those likely to sexually harass or aggress, as indicated by their greater attraction towards a female confederate after only power, not sex, was primed.

There are two major ways of establishing the existence of such automatic connections: through analyses of output order in free recall memory measures ("clustering"), and through sequential priming techniques.

Clustering Measures of Memory Organization

Free recall measures of memory can be utilized to get at the underlying structure and organization of memory. The guiding logic here is that the order with which participants remember, and hence write down, what they remember about a person or event reflects the way it has been encoded in memory. The connections formed between the elements of the person or event help determine what is most easily recalled later on. Given that judgments and decisions are often made based on what is later most easily recalled from memory about the person or event (see Hastie & Park, 1986), the organization of material in memory can later determine, in a passive way, the outcome of those judgments.

Before one can examine clustering, free recall protocols must first be coded for whether each item written by the participant should be considered "correct". Whereas the appropriate unit of analysis (i.e., what is coded as correct or incorrect) is clear with single-word recall paradigms, it is not so clear when the stimulus materials involve behavioral phrases or

prose paragraphs. Although either a strict "verbatim" criterion or a more lenient "general meaning" or "gist" criterion may be used in these cases, researchers have normally not found significant differences in their results based on the use of these different criteria. Many end up basing their final analyses solely on the leniently scored "gist" protocols, in which an item is scored as correct if it captures the primary concept or meaning expressed in the original item (see Chartrand & Bargh, 1996; Hamilton et al., 1980a, 1980b). However, researchers should choose the criterion most appropriate for their particular study based on whether verbatim recall is theoretically necessary to show or not.

A related issue concerns "intrusions" in free recall, which are items "recalled" by participants that were not present in the original stimulus material (see Srull, 1984, for a more in-depth discussion of intrusions). Because intrusion rates may vary across experimental conditions in a systematic way, they should be analyzed and reported by researchers. It is possible to use intrusions in free recall as an indication of information "added in" to a memory by the schema or stereotype used to encode the original information, but as intrusions in free recall are typically rare, such studies have mainly used recognition memory tests in which "hit rates" (yeses to actually presented items) and "false alarm rates" (yeses to test foils that had never been presented) can be compared to separate out accurate retrieval from guessing biases (see Grier, 1971; Srull, 1984; Wyer & Gordon, 1982).

The most common method of determining the amount of clustering in free recall protocols is to use one of various objective clustering techniques, in which the conceptual categories organizing the information are specified a priori by the experimenter. Many different clustering methods exist, each with their own equation that yields an overall clustering "score" for each recall protocol. One of the most widely used measures of category clustering in free recall, the Bousfield and Bousfield (1966) deviation (BBD) measure, was one of the first to be developed. Essentially, this measure is a ratio of observed category repetitions to the number of such repetitions expected on the basis of chance.

One limitation of the BBD is that there is no fixed upper bound; a positive score indicates clustering above chance, but it is impossible to determine whether the score reflects perfect or less than perfect clustering. Specifically, the score for perfect or maximum possible clustering changes with the number of categories that the participant recalls and

with the distribution of the total items recalled across categories. Furthermore, the BBD is affected by the total number of items recalled. Finally, since it does not reflect a proportion of actual to total category repetitions above chance, it is difficult to make comparisons between experiments or between participants.

Alternative clustering measures do exist, however, such as the modified ratio of repetition (MRR; Bower, Lesgold, & Tieman, 1969), the clustering (C) index, and the deviation (D) index (Dalrymple-Alford, 1970). Robertson's (1985) model-based measure of clustering, κ , is highly related to the clustering index, but requires an iterative procedure to calculate its value. It has the advantage of placing more weight on those repetitions occurring at the beginning of the recall list, less to those in the middle of the recall list, and no weight to any repetitions occurring at the end of the recall list. (Also see Robertson, 1995, for a model of recall order that incorporates the clustering information with the serial order in which they are recalled, and any interaction between presentation order effects and clustering.)

Many researchers have argued that the adjusted-ratio-of-clustering (ARC) index developed by Roenker, Thompson, and Brown (1971) is the best overall measure currently available (Murphy, 1979; Ostrom, Pryor, & Simpson, 1981; Srull, 1984; Wyer & Gordon, 1982). Unlike many of the alternative measures, ARC yields a clustering score ranging from 0, indicating no clustering beyond what would be expected by chance, to 1, indicating perfect clustering. Moreover, it corrects for different numbers of categories that are presented as well as the number of categories recalled. Finally, ARC appears to be the least confounded with extraneous factors (Murphy, 1979). The computational formula for ARC is:

$$ARC = \frac{R - E(R)}{N - K - E(R)}$$

where

R = number of observed category repetitions,
 N = total number of all items recalled,
 K = number of conceptual categories represented in the presentation list, and
 $E(R)$ = expected number of category repetitions, $(\sum m(l)^2 / N) - 1$, where m is the number of items from category l that are recalled.

Although researchers should choose clustering measures carefully, it should be noted that the various

formulas are often highly intercorrelated. For instance, Hamilton et al. (1980b) and Chartrand and Bargh (1996) used both the BBD and ARC measures in their analyses of clustering, and found the same pattern of means with both indices.

Although these objective clustering measures are very popular, there exist alternative techniques for recall output analysis. One such alternative involves calculating conditional probabilities, and is best exemplified by Srull's research on person memory (Srull, 1981; Srull, Lichtenstein, & Rothbart, 1985; Srull & Wyer, 1989). Participants were presented with a series of behaviors by a target person and instructed to form an impression of him or her. Most of the behaviors were consistent with a certain personality trait (e.g., honest) but a minority were inconsistent (e.g., dishonest) or unrelated to the trait in question. By examining the order in which the behaviors could later be recalled, and calculating conditional probabilities of recalling one type (e.g., inconsistent), given that the same or another type (e.g., consistent) had just previously been recalled, Srull and his colleagues could construct a sophisticated process model of the process of impression formation.

This model could make accurate, detailed predictions about how people give consideration to unexpected, impression-inconsistent information and attempt to reconcile and integrate these behaviors into an overall, coherent impression of the target. These predictions were generated from a model of associative structure, deduced backwards from a fine-grained analysis of recall output order — tracing the mental route participants took to retrieve each target behavior. Importantly, calculating conditional probabilities was the more appropriate method of analysis in these studies, as levels of category clustering by the objective measures were at near-chance levels. Yet there did exist a highly systematic nature to the order of items recalled, which was uncovered using this different technique.

Sequential Priming Techniques

The sequential priming task permits conclusions about the automaticity of associative connections between memory representations. By varying the time delay between the presentation of a prime stimulus and of a target stimulus, and assessing the effect of the prime on responses to the target under these different time gaps, inferences can be drawn as to whether the effect was immediate and automatic, or conscious and strategic. Essentially, if presentation of the prime affects responses to the

target at time gaps too short for temporary, strategic responses to have been responsible, then the prime and target concepts can be said to be structurally associated in long-term memory. Accordingly, sequential priming tasks have become one of the most widely used experimental techniques in social psychological research on memory structure and automaticity.

Associative network theory (e.g., Anderson & Bower, 1973; Srull, 1981; Wyer & Carleton, 1979) holds that memory consists of interconnected nodes, with activation spreading automatically from one node to another. Activation will only spread if there is an associative link that has been formed, and the stronger the association the more and faster the activation will spread to the related node. Early experiments testing associative network theory showed that responses to a target item (e.g., NURSE) were faster if an associated node (e.g., DOCTOR) had just been activated (Meyer & Schvaneveldt, 1971). Presumably, activation had spread from the node representing the prime to that representing the target so that when the target was presented, that location was already activated and so required time to be activated in the response process.

Posner and Snyder (1975) added a strategic mode or component to spreading activation theory. They held that automatic activation effects were the default, but could be overruled by a current goal or strategy in the task if sufficient time were allowed for this attention-demanding strategy to operate. Automatic sequential priming effects for prime-target pairs such as doctor-nurse or sun-moon were relatively fast, occurring in 300 milliseconds or less. Temporary strategic effects, on the other hand, take longer to develop, because they require attentional (effortful) resources that take time to accrue (Logan, 1980). However, if there is attentional capacity and sufficient time, strategic expectancies are capable of inhibiting and overruling the automatic activation (see also Shallice, 1972).

Neely (1977) tested this model by varying the amount of time between the prime presentation onset and the target presentation onset, known as the "stimulus onset asynchrony" or SOA. On each trial, a prime appeared in the center of the display for a certain amount of time, then was erased, and the target word was presented at the same location. Target words were members of the category BODY (i.e., parts of the body such as heart or leg) or the category FURNITURE (e.g., chair, table), or were nonwords (e.g., trone). The prime stimulus was either

the word BODY or the word FURNITURE. The participants' task was one of lexical decision in which they were to respond whether a target was a word or a nonword, as quickly as they could.

A key element of Neely's (1977) design was to vary the delay between prime and target presentation. With brief delays (e.g., 250 ms), only automatic effects should be able to occur; thus, the prime BODY should facilitate (speed up) responses to names of parts of the body (and likewise for FURNITURE and names of pieces of furniture) because strong, automatic connections are assumed to exist between these target concepts and their higher-order category concept. Only with longer delays (e.g., 750 ms) should strategic conscious expectations be able to influence responses. In the critical experimental condition, participants had a conscious expectancy for the opposite of the semantically-consistent prime-target combination. In other words, they expected the BODY prime to be followed by names of pieces of furniture and for FURNITURE to be followed by names of body parts. However, the automatic effect would remain the same as always, as it reflects long-term associations and can not flexibly adapt to temporarily altered circumstances. In line with the Posner-Snyder model, Neely (1977) found that under these conditions the category-name primes continued to facilitate responses to members of that category under the short prime-target delay conditions, but that under the longer prime-target delay, category-name primes facilitated responses to members of the alternative category.

The sequential priming paradigm used by Meyer and Schvaneveldt (1971) and Neely (1977) has been employed increasingly to study social psychological phenomena. Fazio et al. (1986) based their original study of automatic attitude activation on the Neely (1977) paradigm. The names of various attitude objects (e.g., basketball, Reagan, ice cream) were presented as primes and positive and negative adjectives (e.g., beautiful, terrible) appeared as targets. The SOA between prime and target was also varied, either 300 or 1000 milliseconds. Instead of the lexical decision task used by previous researchers, Fazio et al. (1986) instructed their participants to evaluate the target adjective as quickly as they could on each trial, by pressing one of two buttons, labeled "good" and "bad" (see Figure 3).

Results showed a reliable effect of at least some sets of attitude object primes on latencies to evaluate the target adjectives, with participants faster

to respond when prime and target were of the same, rather than the opposite valence. Importantly, this effect was found only for the short and not the long SOA conditions. For the attitude objects to affect the target evaluations at such short SOAs, the attitude object prime had to have activated its own evaluation before the target was presented — that is, within 300 milliseconds — and this is too quickly to have been the product of some conscious and intentional process. Moreover, the effect did not occur when participants did have enough time (i.e., the 1000 SOA condition) to prepare, strategically, a response based on the prime valence. This was presumably because prime valence was not diagnostic as to the valence of the target that followed; positive primes were followed half of the time by positive and half by negative primes, and the same for negative primes.

The outcome of these and subsequent studies on automatic attitude activation (Bargh, Chaiken, Gvender, & Pratto, 1992; Bargh, Chaiken, Raymond, & Hymes, 1996; Roskos-Ewoldsen & Fazio, 1992) have been uniformly consistent with the hypothesis that attitude objects immediately and automatically activate their associated evaluations in memory.⁸ Because the evaluations are made so quickly and without conscious intention, many researchers have now made use of the paradigm to investigate social attitudes that people are reticent to admit, such as stereotypic or negative views of social groups (e.g., Perdue, Dovidio, Gurtman, & Tyler, 1990). Because the dependent measure is the latency to respond in an innocuous task, there is no way for participants to strategically respond in a way that hides these automatic evaluations.

Fazio, Jackson, Dunton, and Williams (1995) used the automatic attitude effect itself as a predictor of prejudicial behavior. By assessing the degree to which African-American faces primed responses to negative adjectives, and slowed down responses to positive adjectives, a measure of the participants' implicit stereotypic beliefs could be constructed unobtrusively. This measure was found to predict the negativity of the participants' behavioral reactions to an African-American experimenter, whereas a self-report measure of racial attitudes did not.

The pronunciation task. Although the evaluation task has become a popular one to use in

⁸There is a difference of opinion about the generality of the effect, and whether it is moderated by the "strength" of the attitude in memory (see, e.g., Chaiken & Bargh, 1993; Fazio, 1993), but a great deal of consensus as to the existence of the automaticity effect itself.

sequential priming paradigms, a pronunciation task may often be preferable. Because the purpose in using the sequential priming paradigm is to establish the unintentional and immediate activation of social concepts and evaluations, conscious and intentional strategies on the part of participants should be eliminated from the paradigm as much as possible. Having participants intentionally evaluate adjectives in the test of attitude automaticity, for example, was problematic for drawing conclusions about the goal-independence or unintentionality of the effect. Participants were consciously thinking in terms of evaluation and were trying to evaluate the target adjectives – would the effect occur when this goal of evaluation was not currently operating? By having participants pronounce as quickly as possible rather than evaluate the targets, it was shown that the effect did not depend on the conscious goal of evaluation (Bargh, Chaiken, et al., 1996).

Balota and Lorch (1986) showed that the pronunciation task has advantages even over some apparently strategy-free tasks such as lexical decision. For one thing, a researcher usually has to discard half of the data gathered in a lexical decision task – the responses to the nonword trials are not of theoretical meaning or importance. For another, lexical decision still involves a *decision* (i.e., word or nonword) about the stimulus and this increases the time needed to respond, and also the variance due to individual differences in the judgment process. In line with these reasons, Balota and Lorch (1986) found that pronunciation was a more sensitive measure of spreading activation than was lexical decision.

The sequential priming paradigm has the potential for illuminating many of the important situational effects that are at the heart of traditional social psychology (e.g., Ross & Nisbett, 1991). Instead of restricting ourselves to tracing the strong associative connections between internal abstract concepts, such as between elements in a stereotype, or between an object and its attitude, one can examine the immediate and unintentional reactions to social situations. This is quite simply accomplished by having the priming stimuli related to the situational features. A first attempt at extending the paradigm to situation-concept relations was successful in demonstrating automatic sexually-related cognitions as a result of priming the situational feature of having power (Bargh, Raymond, Pryor, & Strack, 1995). Participants identified as likely to be sexual harassers or aggressors showed the sequential priming effect of power on sexually related stimuli in a pronunciation task, and in a second experiment were more attracted

to a female confederate (compared to other participants) if the concept of power had been primed. Thus the sequential priming paradigm would seem to have great promise for investigating other automatic effects of situations – as well as individual differences in these reactions.

Some Issues Concerning the Use of Response Latencies as a Dependent Variable

The key dependent variable in the automatic evaluation studies, as in many other lines of social cognition research (e.g., the content of the self-schema; see Markus, 1977), is the speed with which a response can be made to the target stimulus. Response latencies can be very informative as to the accessibility and automaticity of concept activation, and as to the automaticity of connections between two concepts (i.e., prime and target stimuli), but there are two important caveats to keep in mind.

First of all, there are usually more components to a response latency than just the one that is of experimental interest. This is true for evaluation, lexical decision, and even pronunciation tasks. Take, for example, the operational definition of attitude strength in terms of latency of responding “good” or “bad” to the name of the attitude object (Fazio et al., 1986). The shorter this latency, the stronger the corresponding attitude was considered to be. However, many other factors influence the latency to respond to a given attitude stimulus, such as word length (it takes more time to read longer words), and word frequency, to name a few. These theoretically uninteresting features of the stimuli proved to be significantly correlated with evaluation latencies in further studies (Bargh et al., 1992). If one uses simple latencies alone, as if the only influence on them were attitude strength, one ends up making some erroneous inferences (e.g., concluding attitudes toward gum are stronger in general than attitudes toward abortion).

Perhaps more importantly, conscious response strategies can influence response latencies, especially those resulting from evaluation tasks. It should be noted, however, that researchers can avoid this particular problem by employing a pronunciation task for the sequential priming procedure, for pronunciation tasks are not as susceptible to response biases as are other tasks.

Rogers (1974) was the first to analyze response latencies to trait terms in self-judgment tasks in terms of both the degree to which the concept was

part of the self concept, and in terms of the participant's strategy in answering the questions. This distinction between the actual latency component of interest and mere response strategy was an important one to make. One common strategy is positive self presentation, causing fast latencies when saying "no" to negative items and "yes" to positive items rather than vice versa. This result could occur either because self concepts are generally positive or because the participant has adopted a strategy of basing his or her response not on the true self concept but on merely matching the response to the positivity or negativity of the item.

Because such response strategies are effortful and require attentional resources, we recommend separating the activation and strategic components by loading attention with a secondary task to see if latencies are affected by the load. To the extent that the latencies are not affected by the load manipulation, this signals the true automaticity or chronic accessibility of the judgment process or underlying mental representation; to the extent memory load increases the latency of response to that item, it can be concluded that the concept could only be responded to effortfully. Without assessing latencies under attentional load, the role played by response strategies remains unclear.

The second important caveat, which holds for all types of sequential priming tasks, is that the distribution of response latencies is typically positively skewed, in that they are constrained at the fast end and not at the slow end. This means a transformation must be carried out to normalize the distribution. There are a variety of possible transformations, such as taking the square root, the natural logarithm, or the reciprocal of the raw latency. The natural logarithm is a milder transformation, whereas taking the reciprocal or square root is somewhat stronger in that they alter the original distribution to a greater extent. The question of which of these transformations should be used has been a matter of some debate. Fazio (1990) recommends the reciprocal transformation, but Winer (1971, p. 400) argues against this as too strongly altering the underlying distribution, recommending instead the natural logarithm. (See also Box, Hunter, & Hunter, 1978, for a comparison of the effects of different transformations.) Perhaps the most reasonable method is to try several transformations (moving from mildest to strongest), examine their relative success in removing the positive skew, and then choose accordingly. Different sorts of tasks may have varying degrees of positive skew associated with them and one wants to pick the

transformation that does the best job in each specific context.

Along with distribution transformation comes the issue of what to do with outliers. These are very long latencies that can greatly affect the means, and thus the outcome and conclusions from the experiment.⁹ It is usual and accepted practice to trim outliers to remove this distorting influence on the results. Some rules of thumb can be suggested:¹⁰

First of all, the same policy of trimming (and for that matter, of transformation) should be used in all of one's experiments as a matter of course.

Secondly, common sense as to what is a reasonable response latency for the task at hand should play a role in determining whether a long response is a true response or an error. For instance, if the task is merely to pronounce each stimulus word as quickly as possible after presentation, latencies of 1.5 or 2 seconds or longer would seem to indicate either a microphone error (e.g., the participant spoke too softly for the microphone to pick up the response) or a failure to follow instructions. But the same latency if the task is to say whether an adjective describes oneself is quite reasonable; it may easily take this long for the person to decide.

Latencies that are too fast to have been reasonable responses should also be trimmed; these are almost always anticipations and not true responses. Typically, latencies shorter than 300 milliseconds are trimmed (and these are usually quite rare) for this reason. (Even the National Basketball Association endorses this 300 millisecond "minimal response time" rule – if less than 0.3 of a second remains on the game clock, no shot is allowed to

⁹ It might be questioned why it is acceptable to routinely perform such trimming with reaction time data when one is not routinely permitted to trim outliers in other forms of dependent measures – e.g., responses at the opposite end of questionnaire scales than are most other responses. While we do not claim to offer a definitive answer to this provocative objection, in a first pass at an answer we would point to the usually small, though meaningful differences between conditions typically obtained with reaction time methods, which can be easily swamped and distorted by just a single outlier; secondly, unlike outliers in questionnaires that are the product of conscious choice, those in reaction time studies are most usually errors of some form and not psychologically meaningful (e.g., a response time of 4 seconds to pronounce "elephant" for a native English speaker).

¹⁰ For a recent example of careful outlier analysis and elimination, see Uleman, Hon, Roelofs, and Moskowitz (1996, pp. 381-382). These researchers also provide useful guidelines for dropping participants with high error rates, and for eliminating the effects of practice, fatigue and boredom that can occur during experiments with many response trials.

count after play is resumed, as it is deemed impossible to get one off in this short a time.)

Thirdly, only truly extreme latencies should be trimmed; for example, those that are over 3 standard deviations above the mean (as in Blair & Banaji, 1996), or only the most extreme 2% of all responses. In the dozen or so published automatic attitude experiments, for instance, only between 1 and 2% of responses were trimmed in each study.

Fourthly and finally, it should be established that the deleted reaction times are equally distributed across conditions. If a disproportionate number of them fall in a given condition or subset of conditions, this implies that they are not random events or errors, but systematic effects of the experimental manipulations.

Because of the usual and recognized need in response latency research to trim and transform the data, it is more important than usual to earn and keep the trust of the consumers of your research by not taking advantage of the situation. Readers of research are rightly suspicious when data is omitted or transformed, as it is easy to imagine the temptation to trim and transform until the "right" results are obtained. The above guidelines should go a long way towards quelling such skepticism.

Uncontrollability

Thus far we have been concerned with the case in which a person is not aware of and does not intend to be perceiving or feeling or behaving in a certain way; it happens in the absence of a conscious intention. But what if the person was made aware of the effect? Could they control responses based on it if they wanted to? *Uncontrollability* of a process is another quality of automaticity, but one that need not follow from the others. That is, it is very possible and probably even likely for one to be affected unintentionally by, say, the current environmental context (as in priming effects) but be able to counteract such effects on judgments or behavior *if one becomes aware* of the potential influence (Strack & Hannover, 1996). Devine (1989) showed that stereotype activation may be unintended, but with the appropriate values, motivation, and task, one can control the effect of the stereotype on responses (see also Fiske, 1989).

This leads to the general observation that although the initial activation events, such as in stereotyping, may not be easily if at all controlled, the

overt responses based on those activated representations are controllable in most cases. Take the classic paradigm for studying uncontrollable activation, the Stroop color-word task (Stroop, 1935; see reviews in Logan, 1980; MacLeod, 1991). In this task, the participant is to name the color in which a word is presented. It is easily shown that people take longer when the word itself – which is irrelevant to the task of naming the color – is the name of a different color (e.g., the word RED presented in green ink).¹¹ Researchers have shown that this effect holds for any stimuli to which the participant is perceptually sensitive, such as those related to his or her chronically accessible social constructs (Bargh & Pratto, 1986) or to discrepancies between his or her actual and ideal self-concepts (Higgins, VanHook, & Dorfman, 1988).

What is often overlooked in this paradigm is that the participants' actual responses in this task are overwhelmingly the correct ones. It is not that people say "red" to the word RED in green ink; they say "green" but take longer to do so, because of the need to inhibit the automatically activated competing response "red" (see Logan, 1980). So it has always been the case that findings of "uncontrollable" automatic effects refer not to uncontrollable responses but to uncontrollable internal activation events.

Again, the key is whether the individual is aware of the possibility of influence. If he or she is not, as in priming or stereotype activation events, biased judgments and even behavior (Bargh et al., 1996) can be the result. But if the participant is made aware, he or she may be able to adjust for and control the effect (though overadjustment may occur; see Strack & Hannover, 1996). Take for example the study by Schwarz and Clore (1983) in which participants were contacted by telephone and asked questions about their life satisfaction. They were called either on a rainy or a sunny day, and if the interviewer did not mention the weather at all, it did affect their responses. Those contacted on a rainy day reported

¹¹There is no reason to limit this technique to the task of color-naming; the logic applies equally well to any task in which an irrelevant dimension of the stimuli suggests the same or a competing response to that dictated by the relevant dimension. In the original Stroop task, the meaning of the stimulus word is an irrelevant dimension, and its color the relevant dimension, but participants cannot help but process the irrelevant feature. But if the task is instead to indicate whether a stimulus word was presented above or below a fixation point, then the word "above" facilitates response times (compared to other words) when presented above the fixation point, and slows down response times when presented below the fixation point (contrariwise for the word "below"; see Logan, 1980).

less satisfaction with their entire life than did those contacted on a sunny day, apparently misattributing their feelings due to the weather in the process. But if the experimenter casually referred to the current weather conditions, the effect disappeared. Calling the participants' attention to the weather made it a piece of information in current working memory, and more salient as a potential cause for their mood later on when they were asked about their life satisfaction.

An interesting variant on this theme is the *opposition* paradigm developed by Jacoby and his colleagues (e.g., Jacoby, 1991; Jacoby et al., 1992). The essence of this procedure is to place conscious and unconscious influences in opposition to each other, so that the unconscious effects happen despite being contrary to intended, conscious purposes. In one study (Jacoby, Kelley, Brown, & Jasechko, 1989), for example, participants were exposed to a series of proper names as part of one experimental session. Half of the participants studied the list under full attention conditions, and the remaining participants studied it under divided attention conditions, having to perform a secondary task at the same time. The point of this attention manipulation was to decrease some participants' ability to later remember the names they had been shown.

Coming back to the lab the next day, the participants were asked to judge the fame of a list of names, which included new famous and new nonfamous names as well as some from the list of the previous day. Participants were told that all of the names they had studied the day before were nonfamous. Thus, if they consciously remembered seeing a name from that prior list, their response would be to say it was nonfamous. But participants from the divided attention condition of the day before would be less able to remember those names, and so less able to sort out whether the felt familiarity of those names came from their actual fame, or from having seen them during the study phase of the experiment. And, as predicted, the divided attention condition participants were more likely than the full attention participants to mistakenly say that the previous day's nonfamous names were actually famous — a demonstration, the authors concluded, of "becoming famous overnight."

Note that neither the current weather conditions, in the Schwarz and Clore study, or the original list of nonfamous names, in the Jacoby et al. (1989) experiment, were presented "subliminally" to participants, below their threshold of conscious awareness. All of the influential information was

originally available to consciousness. The sub- or supraliminality of the influential stimulus was not the critical factor in being influenced unintentionally and being unable to attempt to control that influence, but the participants' awareness of the potential effect of that (consciously perceived) stimulus.

How Control Attempts Can Produce Uncontrollability

Wegner and his colleagues (e.g., Ansfield & Wegner, 1996; Wegner, 1994; Wegner & Erber, 1992) have generated a substantial body of evidence on uncontrollable processing effects. The basic experimental technique involves having participants engage in an attention-demanding secondary task while they are trying to prevent something from happening. Wegner's (1994) *ironic process model* make the specific prediction that distraction and other strains on attentional capacity actually increase the likelihood that the counterintentional process will occur. That is, trying *not* to do something involves keeping in mind what it is that one does not want to happen, in order to maintain vigilance against it. But this has the ironic side effect of increasing the activation or accessibility of precisely those thoughts and behavior representations that one desires to control or prevent. Because the act of inhibiting or controlling them is effortful and attention-demanding (see Logan, 1980; Posner & Snyder, 1975; Shallice, 1972), trying not to do something under divided attention conditions will often have the ironic effect of making it more, not less likely that one will do it. This is because one is left with the increased activation without the inhibition.

Ansfield and Wegner (1996) report a series of experiments based on the Chevreul pendulum illusion, in which one is told to keep a pendulum still and not to let it move in a certain direction. As predicted by ironic process theory, having participants count backwards from 1000 by 7's while holding the pendulum caused the pendulum to move — as if by magic — exactly in the unintended direction. Ironic process theory identified a very large domain of uncontrollable mental processes — all of those one *intends to control*, but cannot because of a current deficit in the attentional capacity needed to do so.

CONCLUSIONS

Priming is a very useful technique for studying the role played by situational context in cognition, motivation, and behavior. Such contextual effects are, if anything, more pervasive in everyday life than many

social psychological theories allow. One's ongoing stream of consciousness continually creates ripples of influence that persist well after the conscious focus has flowed on to other things. And our conscious goals and purposes also continue to influence us after their originally intended task has been completed or abandoned.

Priming is also used to experimentally manipulate states of mind that are analogous to individual differences in automatic processing. One can select people based on these chronic differences, such as those high on achievement motivation or those with a chronically accessible trait construct for honesty, and compare their performance on a task or their perceptions of a target person with those of participants without these chronic states. However, these groups of individuals could well differ in other ways as well, and they are self-selecting into the experimental conditions. A researcher's confidence in the focal independent variable as the real cause of an effect in individual difference research is bolstered if he or she can also produce the effect experimentally. Thus priming research is a natural complement to automaticity research.

The importance of studying automaticity resides in the ecological importance of the particular quality of automaticity that is under scrutiny. That is, it is important to study the efficiency or attention-free nature of a process when one wants to see if it would occur even in cognitively busy circumstances – and it is our feeling that these conditions are more the rule than the exception in life. And it is important to study whether a process occurs unintentionally or not because of the implications it has, in conjunction with lack of awareness, for the individual's ability to control it. If the process only happens when the person intends it, those with good intentions have nothing to fear. But in many cases good intentions go for naught because the person does not choose and is not aware of the perceptual or motivational process affecting him or her. And this lack of both intention and awareness may preclude controllability of the process.

Research into such automatic effects helped to raise the general public's consciousness in the 1970s and 80s about the possibility of nonconscious bias, especially in racial and gender stereotyping. Further study of these unseen hands of automatic influence can only continue to do more such good. After all, it is only with such knowledge and awareness that one can hope to counteract those influences. An exciting contemporary trend in research, in fact, is aimed at discovering the conditions under which

unwanted automatic influences, as in stereotyping, can be controlled or even changed.

But not all automatic influences are unwanted and counter-productive; quite the opposite. There is a natural tendency to assume, based on the findings of an automatic or nonconscious role in such social and personal problems as prejudice, sexual harassment, and depression, that automatic mental processes are always associated with negative outcomes, and conscious mental control with positive outcomes. Indeed, several influential authors have made just this argument (e.g., Bandura, 1986; Langer, 1989; Mischel, Cantor, & Feldman, 1996). Yet it is the natural purview of social psychologists to study social problems, and so the problematic ones are likely to be overrepresented in the roll call of researched automatic phenomena.

Habits of thought and behavior can be helpful as well as harmful: William James (1890) famously advised the young to make habitual as soon as possible all the useful behaviors one could. Just as negative stereotypes can be activated automatically, so too can chronic fairness motives (Moskowitz et al., 1997). Just as depressives think about themselves automatically in negative terms, so too do nondepressives think about themselves in automatically positive terms (Bargh & Tota, 1988), which turns out to be an important component of psychological health (e.g., Taylor & Brown, 1988). Therefore, another good tack for future research – besides the continued probe of how to control undesired automatic and contextual (priming) effects – might be to investigate the roles played by priming and automaticity in psychological health and socially constructive behavior. After all, nonconscious phenomena can be created and developed, as well as controlled and changed.

York: Guilford.

References

Allport, F. H. (1955). Theories of perception and the concept of structure. New York: Wiley.

Andersen, S. M., Spielman, L. A., & Bargh, J. A. (1992). Future-event schemas and certainty about the future: Automaticity in depressives' future-event predictions. Journal of Personality and Social Psychology, *63*, 711-723.

Anderson, J. R. (1982). Acquisition of cognitive skill. Psychological Review, *89*, 369-406.

Anderson, J. R., & Bower, G. H. (1973). Human associative memory. New York: Winston.

Ansfield, M. E., & Wegner, D. M. (1996). The feeling of doing. In P. M. Gollwitzer & J. A. Bargh (Eds.), The psychology of action: Linking cognition and motivation to behavior (pp. 482-506). New York: Guilford.

Balota, D. A., & Lorch, R. F., Jr. (1986). Depth of automatic spreading activation: Mediated priming effects in pronunciation but not in lexical decision. Journal of Experimental Psychology: Learning, Memory, and Cognition, *12*, 336-345.

Banaji, M. R., Hardin, C., & Rothman, A. J. (1993). Implicit stereotyping in person judgment. Journal of Personality and Social Psychology, *65*, 272-281.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

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. (1990). Auto-motives: Preconscious determinants of social interaction. In E. T. Higgins & R. M. Sorrentino (Eds.), Handbook of motivation and cognition (Vol. 2, pp. 93-130). New York: Guilford Press.

Bargh, J. A. (1992). Being unaware of the 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

Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In R. S. Wyer & T. K. Srull (Eds.), Handbook of social cognition (2nd ed., Vol. 1, pp. 1-40). Hillsdale, NJ: Erlbaum.

Bargh, J. A. (1996). Principles of automaticity. In E. T. Higgins & A. Kruglanski (Eds.), Social psychology: Handbook of basic principles (pp. 169-183). New York: Guilford.

Bargh, J. A. (1997). The automaticity of everyday life. Target chapter In R. S. Wyer, Jr. (Ed.), Advances in social cognition (Vol. 10, pp. 1-61). Mahwah, NJ: Erlbaum.

Bargh, J. A., & Barndollar, K. (1996). Automaticity in action: The unconscious as a repository of chronic goals and motives. In P. M. Gollwitzer & J. A. Bargh (Eds.), The psychology of action (pp. 457-481). New York: Guilford.

Bargh, J. A., Bond, R. N., Lombardi, W. J., & Tota, M. E. (1986). The additive nature of chronic and temporary sources of construct accessibility. Journal of Personality and Social Psychology, *50*, 869-878.

Bargh, J. A., Chaiken, S., Govender, R., & Pratto, F. (1992). The generality of the automatic attitude activation effect. Journal of Personality and Social Psychology, *62*, 893-912.

Bargh, J. A., Chaiken, S., Raymond, P., & Hymes, C. (1996). The automatic evaluation effect: Unconditionally automatic attitude activation with a pronunciation task. Journal of Experimental Social Psychology, *32*, 185-210.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. Journal of Personality and Social Psychology, *71*, 230-244.

Bargh, J. A., & Gollwitzer, P. M. (1994). Environmental control of goal-directed action: Automatic and strategic contingencies between situations and behavior. In W. Spaulding (Ed.), Integrations of motivation and cognition: The Nebraska Symposium on Motivation (Vol. 41, pp. 71-124). Lincoln: University of Nebraska Press.

Bargh, J. A., Gollwitzer, P. M., Lee-Chai, A. Y., & Barndollar, K. (1997). Social ignition: Motivational

PRIMING AND AUTOMATICITY RESEARCH

qualities of primed goal states. Manuscript submitted for publication, New York University.

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.

Bargh, J. A., & Pratto, F. (1986). Individual construct accessibility and perceptual selection. Journal of Experimental Social Psychology, 22, 293-311.

Bargh, J. A., Raymond, P., Pryor, J., & Strack, F. (1995). The attractiveness of the underling: An automatic power-sex association and its consequences for sexual harassment and aggression. Journal of Personality and Social Psychology, 68, 768-781.

Bargh, J. A., & Thein, R. D. (1985). Individual construct accessibility, person memory, and the recall-judgment link: The case of information overload. Journal of Personality and Social Psychology, 49, 1129-1146.

Bargh, J. A., & Tota, M. E. (1988). Context-dependent automatic processing in depression: Accessibility of negative constructs with regard to self but not others. Journal of Personality and Social Psychology, 54, 925-939.

Bator, R. J., & Cialdini, R. B. (1995). Priming a consistency motivation enhances cognitive dissonance effects. Manuscript submitted for publication, Arizona State University.

Beck, A. T. (1967). Depression: Clinical, experimental, and theoretical aspects. New York: Harper & Row.

Blair, I., & Banaji, M. (1996). Automatic and controlled processes in stereotype priming. Journal of Personality and Social Psychology, 70, 1142-1163.

Bodenhausen, G., & Macrae, N. (1998). In R. S. Wyer (Ed.), Advances in social cognition (Vol. 11). Mahwah, NJ: Erlbaum.

Boring, E. G. (1950). A history of experimental psychology (2/e). New York: Appleton-Century-Crofts.

Bousfield, A. K., & Bousfield, W. A. (1966). Measurement of clustering and sequential constancies in repeated free recall. Psychological Reports, 19, 935-942.

Bower, G. H., Lesgold, A. M., & Tieman, D. (1969). Grouping operations in free recall. Journal of Verbal Learning and Verbal Behavior, 8, 481-493.

Box, G. E. P., Hunter, W. G., & Hunter, J. S. (1978). Statistics for experimenters. New York: Wiley.

Brenner, M. (1973). The next-in-line effect. Journal of Verbal Learning and Verbal Behavior, 12, 320-323.

Brewer, M. B. (1988). A dual process model of impression formation. In T. K. Srull & R. S. Wyer, Jr. (Eds.), Advances in social cognition (Vol. 1, pp. 1-36). Hillsdale, NJ: Erlbaum.

Bruner, J. S. (1957). On perceptual readiness. Psychological Review, 64, 123-152.

Bruner, J. S., & Postman, L. (1947). Value and need as organizing factors in perception. Journal of Abnormal and Social Psychology, 42, 33-44.

Carver, C. S., Ganellen, R. J., Froming, W. J., & Chambers, W. (1983). Modeling: An analysis in terms of category accessibility. Journal of Experimental Social Psychology, 19, 403-421.

Chaiken, S., & Bargh, J. A. (1993). Occurrence versus moderation of the automatic attitude activation effect: Reply to Fazio. Journal of Personality and Social Psychology, 64, 759-765.

Chaiken, S., Giner-Sorolla, R., & Chen, S. (1996). Beyond accuracy: Defense and impression motives in heuristic and systematic information processing. In P. M. Gollwitzer & J. A. Bargh (Eds.), The psychology of action (pp. 553-578). New York: Guilford.

Chartrand, T. L., & Bargh, J. A. (1996). Automatic activation of impression formation and memorization goals: Nonconscious goal priming reproduces effects of explicit task instructions. Journal of Personality and Social Psychology, 71, 464-478.

Chen, S., Shechter, D., & Chaiken, S. (1996). Getting at the truth or getting along: Accuracy and impression-motivated heuristic and systematic

PRIMING AND AUTOMATICITY RESEARCH

processing. Journal of Personality and Social Psychology, 71, 262-275.

Cialdini, R. B. (1994, October). The strain for consistency: A history, a measure, and a surprise. Plenary address to the annual meetings of the Society for Experimental Social Psychology, Lake Tahoe, NV.

Costin, F. (1969). The scrambled sentence test: A group measure of hostility. Educational and Psychological Measurement, 29, 461-468.

Dalrymple-Alford, E. C. (1970). The measurement of clustering in free recall. Psychological Bulletin, 1, 32-34.

Dennett, D. C. (1985). Elbow room: The varieties of free will worth wanting. Cambridge, MA: M.I.T. Press.

Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. Journal of Personality and Social Psychology, 56, 680-690.

Dixon, N. F. (1971). Subliminal perception: The nature of a controversy. New York: McGraw-Hill.

Dodge, K. A. (1993). Social-cognitive mechanisms in the development of conduct disorder and depression. Annual Review of Psychology, 44, 559-584.

Duncker, K. (1945). On problem solving. Psychological Monographs, 58 (5, Whole No. 270).

Eagly, A. H., & Chaiken, S. (1993). The psychology of attitudes. New York: Harcourt Brace Jovanovich.

Edwards, K. (1990). The interplay of affect and cognition in attitude formation and change. Journal of Personality and Social Psychology, 59, 202-216.

Erdelyi, M. H. (1974). A new look at the New Look: Perceptual defense and vigilance. Psychological Review, 81, 1-25.

Erdley, C. A., & D'Agostino, P. R. (1988). Cognitive and affective components of automatic priming effects. Journal of Personality and Social Psychology, 54, 741-747.

Ericsson, K. A., & Simon, H. A. (1980). Verbal

reports as data. Psychological Review, 87, 215-251.

Fazio, R. H. (1990). A practical guide to the use of response latencies in social psychological research. In C. Hendrick & M. S. Clark (Eds.), Review of Personality and Social Psychology (Vol. 11, pp. 74-97). Newbury Park, CA: Sage.

Fazio, R. H. (1993). Variability in the likelihood of automatic attitude activation: Data reanalysis and commentary on Bargh, Chaiken, Gvender, and Pratto (1992). Journal of Personality and Social Psychology, 64, 753-758.

Fazio, R. H., Chen, J., McDonel, E. C., & Sherman, S. J. (1982). Attitude accessibility, attitude-behavior consistency, and the strength of the object-evaluation association. Journal of Experimental Social Psychology, 18, 339-357.

Fazio, R. H., Jackson, J. R., Dunton, B. C., & Williams, C. J. (1995). Variability in automatic activation as an unobtrusive measure of racial attitudes: A bona fide pipeline? Journal of Personality and Social Psychology, 69, 1013-1027.

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.

Fischer, B., & Weber, H. (1993). Express saccades and visual attention. Behavioral and Brain Sciences, 16, 553-610.

Fiske, S. T. (1980). Attention and weight in person perception: The impact of negative and extreme behavior. Journal of Personality and Social Psychology, 38, 889-906.

Fiske, S. T. (1989). Examining the role of intent: Toward understanding its role in stereotyping and prejudice. In J. S. Uleman & J. A. Bargh (Eds.), Unintended thought (pp. 253-283). New York: Guilford.

Fiske, S. T., & Neuberg, S. E. (1990). A continuum of impression formation, from category-based to individuating processes: Influences of information and motivation on attention and interpretation. In M. P. Zanna (Ed.), Advances in experimental social psychology (Vol 23, pp. 1-74). San Diego: Academic Press.

Fowler, C. A., Wolford, G., Slade, R., &

PRIMING AND AUTOMATICITY RESEARCH

Tassinari, L. (1981). Lexical access with and without awareness. Journal of Experimental Psychology: General, 110, 341-362.

Gilbert, D. T. (1989). Thinking lightly about others: Automatic components of the social inference process. In J. S. Uleman & J. A. Bargh (Eds.), Unintended thought (pp. 189-211). New York: Guilford.

Gilbert, D. T. (1993). The assent of man: Mental representation and the control of belief. In D. M. Wegner & J. W. Pennebaker (Eds.), Handbook of mental control (pp. 57-87). Englewood Cliffs, NJ: Prentice-Hall.

Gilbert, D. T., & Hixon, J. G. (1991). The trouble of thinking: Activation and application of stereotypic beliefs. Journal of Personality and Social Psychology, 60, 509-517.

Gilbert, D. T., & Osborne, R. E. (1989). Thinking backward: Some curable and incurable consequences of cognitive busyness. Journal of Personality and Social Psychology, 57, 940-949.

Gilbert, D. T., Pelham, B. W., & Krull, D. S. (1998). On cognitive busyness: When persons perceivers meet persons perceived. Journal of Personality and Social Psychology, 54, 733-740.

Gollwitzer, P. M. (1990). Action phases and mind-sets. In E. T. Higgins & R. M. Sorrentino (Eds.), Handbook of motivation and cognition (Vol. 2, pp. 53-92). New York: Guilford.

Gollwitzer, P. M., & Bargh, J. A. (Eds., 1996). The psychology of action. New York: Guilford.

Gollwitzer, P. M., Heckhausen, H., & Steller, B. (1990). Deliberative and implemental mind-sets: Cognitive tuning toward congruous thoughts and information. Journal of Personality and Social Psychology, 59, 1119-1127.

Gollwitzer, P. M., & Moskowitz, G. B. (1996). Goal effects on action and cognition. In E. T. Higgins & A. W. Kruglanski (Eds.), Social psychology: Handbook of basic principles (pp. 361-399). New York: Guilford.

Grand, S., & Segal, S. J. (1966). Recovery in the absence of recall. Journal of Experimental Psychology, 72, 138-144.

Greenwald, A. G. (1992). New Look 3: Unconscious cognition reclaimed. American Psychologist, 47, 6, 766-779.

Greenwald, A. G., Draine, S. C., & Abrams, R. L. (1996). Three cognitive markers of unconscious semantic activation. Science, 273, 1699-1702.

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. Psychological Review, 102, 4-27.

Greenwald, A. G., Klinger, M. R., & Liu, T. J. (1989). Unconscious processing of dichoptically masked words. Memory and Cognition, 17, 35-47.

Grier, J. B. (1971). Nonparametric indexes for sensitivity and bias: Computing formulas. Psychological Bulletin, 75, 424-429.

Hamilton, D. L., Katz, L. B., & Leirer, V. O. (1980a). Cognitive representation of personality impression: Organizational processes in first impression formation. Journal of Personality and Social Psychology, 39, 1050-1063.

Hamilton, D. L., Katz, L. B., & Leirer, V. O. (1980b). Organizational processes in impression formation. In R. Hastie, T. M. Ostrom, E. B. Ebbesen, R. S. Wyer, Jr., D. L. Hamilton, & D. E. Carlston (Eds.), Person memory: The cognitive basis of social perception (pp. 121-153). Hillsdale, NJ: Erlbaum.

Hastie, R., & Kumar, P. A. (1979). Person memory: Personality traits as organizing principles in memory for behaviors. Journal of Personality and Social Psychology, 37, 25-38.

Hastie, R., & Park, B. (1986). The relationship between memory and judgment depends on whether the judgment task is memory-based or on-line. Psychological Review, 93, 258-268.

Herr, P. M. (1986). Consequences of priming: Judgment and behavior. Journal of Personality and Social Psychology, 51, 1106-1115.

Herr, P. M., Sherman, S. J., & Fazio, R. H. (1984). On the consequences of priming: Assimilation and contrast effects. Journal of Experimental Social Psychology, 19, 323-340.

Higgins, E. T. (1989). Knowledge accessibility and activation: Subjectivity and suffering from unconscious sources. In J. S. Uleman & J. A. Bargh

PRIMING AND AUTOMATICITY RESEARCH

(Eds.), Unintended thought (pp. 75-123). New York: Guilford.

Higgins, E. T. (1996). Knowledge activation: Accessibility, applicability, and salience. In E. T. Higgins & A. Kruglanski (Eds.), Social psychology: Handbook of basic principles (pp. 133-168). New York: Guilford.

Higgins, E. T., Bargh, J. A., & Lombardi, W. (1985). Nature of priming effects on categorization. Journal of Experimental Social Psychology, *11*, 59-69.

Higgins, E. T., & Chaires, W. M. (1980). Accessibility of interrelational constructs: Implications for stimulus encoding and creativity. Journal of Experimental Social Psychology, *16*, 348-361.

Higgins, E. T., & King, G. A. (1981). Accessibility of social constructs: Information-processing consequences of individual and contextual variability. In N. Cantor & J. F. Kihlstrom (Eds.), Personality, cognition, and social interaction (pp. 69-122). Hillsdale, NJ: Erlbaum.

Higgins, E. T., Rholes, W. S., & Jones, C. R. (1977). Category accessibility and impression formation. Journal of Experimental Social Psychology, *13*, 141-154.

Higgins, E. T., VanHook, E., & Dorfman, D. (1988). Do self-attributes form a cognitive structure? Social Cognition, *6*, 177-217.

Holender, D. (1986). Semantic activation without conscious identification in dichotic listening, parafoveal vision, and visual masking: A survey. Behavioral and Brain Sciences, *9*, 1-66.

Jacoby, L. L. (1991). A process dissociation framework: Separating automatic from intentional uses of memory. Journal of Memory and Language, *30*, 513-541.

Jacoby, L. L., Kelley, C., Brown, J., & Jasechko, J. (1989). Becoming famous overnight: Limits on the ability to avoid unconscious influences of the past. Journal of Personality and Social Psychology, *56*, 326-338.

Jacoby, L. L., Lindsay, D. S., & Toth, J. P. (1992). Unconscious influences revealed: Attention, awareness, and control. American Psychologist, *47*, 802-809.

James, W. (1890). Principles of psychology. New York: Holt.

Johnson, M. K., & Hasher, L. (1987). Human learning and memory. Annual Review of Psychology, *38*, 631-668.

Kantowitz, B. H. (1974). Double stimulation. In B. H. Kantowitz (Ed.), Human information processing. Hillsdale, NJ: Erlbaum.

Koestler, A. (1967). The ghost in the machine. London: Hutchinson & Co.

Koffka, K. (1922). Perception: An introduction to the Gestalt-theorie. Psychological Bulletin, *19*, 531-585.

Koriat, A., & Feuerstein, N. (1976). The recovery of incidentally acquired information. Acta Psychologica, *40*, 463-464.

Langer, E. J. (1978). Rethinking the role of thought in social interaction. In J. H. Harvey, W. I. Ickes, & R. F. Kidd (Eds.), New directions in attribution research (Vol. 2, pp. 35-58). Hillsdale, NJ: Erlbaum.

Langer, E. J. (1989). Mindfulness. New York: Allyn & Bacon.

Lashley, K. S. (1951). The problem of serial order in behavior. In L. A. Jeffress (Ed.), Cerebral mechanisms in behavior: The Hixon symposium (pp. 112-136). New York: Wiley & Sons.

Linville, P. (1996). Attention inhibition: Does it underlie ruminative thought? In R. S. Wyer, Jr. (Ed.), Advances in social cognition (Vol. 9, pp. 121-133). Mahwah, NJ: Erlbaum.

Logan, G. D. (1980). Attention and automaticity in Stroop and priming tasks: Theory and data. Cognitive Psychology, *12*, 523-553.

Logan, G. D., & Cowan, W. (1984). On the ability to inhibit thought and action: A theory of an act of control. Psychological Review, *91*, 295-327.

Lombardi, W. J., Higgins, E. T., & Bargh, J. A. (1987). The role of consciousness in priming effects on categorization. Personality and Social Psychology Bulletin, *13*, 411-429.

Macrae, C. N., Hewstone, M., & Griffiths, R. J. (1993). Processing load and memory for stereotype-

PRIMING AND AUTOMATICITY RESEARCH

based information. European Journal of Social Psychology, 23, 77-87.

Macrae, C. N., Milne, A. B., & Bodenhausen, G. V. (1994). Stereotypes as energy-saving devices: A peek inside the cognitive toolbox. Journal of Personality and Social Psychology, 66, 37-47.

Marcel, A. J. (1983). Conscious and unconscious perception: Experiments on visual masking and word recognition. Cognitive Psychology, 15, 197-237.

Marks, M. M., Sinclair, R. C., & Wellens, T. R. (1991). The effect of completing the Beck Depression Inventory on self-reported mood state: Contrast and assimilation. Personality and Social Psychology Bulletin, 17, 457-465.

Markus, H. (1977). Self-schemata and processing information about the self. Journal of Personality and Social Psychology, 35, 2, 63-78.

MacLeod, C. (1991). Half a century of research on the Stroop effect: An integrative review. Psychological Bulletin, 109, 163-203.

Mischel, W. (1973). Toward a cognitive social learning reconceptualization of personality. Psychological Review, 80, 252-283.

Mischel, W., Cantor, N., & Feldman, S. (1996). Principles of self-regulation: The nature of willpower and self-control. In E. T. Higgins & A. W. Kruglanski (Eds.), Social psychology: Handbook of basic principles (pp. 329-360). New York: Guilford.

Meyer, D. E., & Schvaneveldt, R. W. (1971). Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. Journal of Experimental Psychology, 90, 227-234.

Moskowitz, G. B., Wasel, W., Gollwitzer, P. M., & Schaal, B. (1997). A model of habitual stereotyping. Manuscript submitted for publication, Princeton University.

Murphy, M. D. (1979). Measurement of category clustering in free recall. In C. R. Puff (Ed.), Memory organization and structure (pp. 51-83). San Diego, CA: Academic press.

Murphy, S. T., Monahan, J. L., & 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. T., & 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.

Neely, J. H. (1977). Semantic priming and retrieval from lexical memory: Roles of inhibitionless spreading activation and limited-capacity attention. Journal of Experimental Psychology: General, 106, 226-254.

Neuberg, S. L. (1988). Behavioral implications of information presented outside of conscious awareness: The effect of subliminal presentation of trait information on behavior in the Prisoner's Dilemma Game. Social Cognition, 6, 207-230.

Neumann, O. (1984). Automatic processing: A review of recent findings and a plea for an old theory. In W. Prinz & A. F. Sanders (Eds.), Cognition and motor processes (pp. 255-293). Berlin: Springer-Verlag.

Newell, A., & Rosenbloom, P. S. (1981). Mechanisms of skill acquisition and the law of practice. In J. R. Anderson (Ed.), Cognitive skills and their acquisition (pp. 1-55). Hillsdale, NJ: Erlbaum.

Newman, L. S., & Uleman, J. S. (1990). Assimilation and contrast effects in spontaneous trait inference. Personality and Social Psychology Bulletin, 16, 224-240.

Niedenthal, P. M. (1990). Implicit perception of affective information. Journal of Experimental Social Psychology, 26, 505-527.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. Psychological Review, 84, 231-259.

Ostrom, T. M., Pryor, J. B., & Simpson, D. D. (1981). The organization of social information. In E. T. Higgins, C. P. Herman, & M. P. Zanna (Eds.), Social cognition: The Ontario Symposium (Vol. 1, pp. 3-38). Hillsdale, NJ: Erlbaum.

Paulhus, D. L., Graf, P., & Van Selst, M. (1989). Attentional load increases the positivity of self-presentation. Social Cognition, 7, 389-400.

Perdue, C. W., Dovidio, J. F., Gurtman, M. B.,

PRIMING AND AUTOMATICITY RESEARCH

& Tyler, R. B. (1990). Us and them: Social categorization and the process of intergroup bias. Journal of Personality and Social Psychology, 59, 475-486.

Posner, M. I., & Snyder, C. R. R. (1975). Attention and cognitive control. In R. L. Solso (Ed.), Information processing and cognition: The Loyola symposium (pp. 55-85). Hillsdale, NJ: Erlbaum.

Postman, L., Bruner, J. S., & McGinnies, E. (1948). Personal values as selective factors in perception. Journal of Abnormal and Social Psychology, 43, 142-154.

Pratto, F., & Bargh, J. A. (1991). Stereotyping based on apparently individuating information: Trait and global components of sex stereotypes under attention overload. Journal of Experimental Social Psychology, 27, 26-47.

Prinz, W. (1990). A common coding approach to perception and action. In O. Neumann & W. Prinz (Eds.), Relationships between perception and action (pp. 167-201). Heidelberg: Springer-Verlag.

Prinz, W. (in press). Perception and action planning. European Journal of Cognitive Psychology.

Rayner, K. (1978). Foveal and parafoveal cues in reading. In J. Requin (Ed.), Attention and performance VIII (pp. 149-161). Hillsdale, NJ: Erlbaum.

Robertson, C. (1985). A measure of categorical clustering based upon a model of recall order. British Journal of Mathematical and Statistical Psychology, 38, 141-151.

Robertson, C. (1995). Modeling recall - Clustering and order effects. British Journal of Mathematical and Statistical Psychology, 48, 29-50.

Roenker, D. L., Thompson, C. P., & Brown, S. C. (1971). Comparison of measures for the estimation of clustering in free recall. Psychological Bulletin, 1, 45-48.

Rogers, T. B. (1974). An analysis of two central stages underlying responding to personality items: The self-referent decision and response selection. Journal of Research in Personality, 8, 128-138.

Roskos-Ewoldsen, D. R., & Fazio, R. H. (1992). On the orienting value of attitudes: Attitude accessibility as a determinant of an object's attraction of visual attention. Journal of Personality and Social Psychology, 63, 198-211.

Ross, L., & Nisbett, R. E. (1991). The person and the situation: Perspectives of social psychology. New York: McGraw-Hill.

Rothbart, M. (1981). Memory processes and social beliefs. In D. L. Hamilton (Ed.), Cognitive processes in stereotyping and intergroup behavior. Hillsdale, NJ: Erlbaum.

Schacter, D. L. (1987). Implicit memory: History and current status. Journal of Experimental Psychology: Learning, Memory, and Cognition, 13, 31-53.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. Journal of Personality and Social Psychology, 45, 513-523.

Seamon, J. G., Brody, N., & Kauff, D.M. (1983). Affective discrimination of stimuli that are not recognized: Effects of shadowing, masking, and cerebral laterality. Journal of Experimental Psychology: Learning, Memory, and Cognition, 9, 544-555.

Segal, S. J. (1967). The priming of association test responses. Journal of Verbal Learning and Verbal Behavior, 6, 216-221.

Segal, S. J., & Cofer, C. N. (1960). The effect of recency and recall on word association. American Psychologist, 15, 451.

Shallice, T. (1972). Dual functions of consciousness. Psychological Review, 79, 383-393.

Shevrin, H. (1992). Subliminal perception, memory, and consciousness: Cognitive and dynamic perspectives. In R. Bornstein & T. Pittman (Eds.) Perception without awareness (pp. 123-142). New York: Guilford.

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.

PRIMING AND AUTOMATICITY RESEARCH

- Skelton, J. A., & Strohmets, D. B. (1990). Priming symptom reports with health-related cognitive activity. Personality and Social Psychology Bulletin, 16, 449-464.
- Smith, E. R. (1994). Procedural knowledge and processing strategies in social cognition. In R. S. Wyer & T. K. Srull (Eds.), Handbook of social cognition (2nd ed., Vol. 1, pp. 99-152). Hillsdale, NJ: Erlbaum.
- Smith, E. R., Branscombe, N., & Bormann, C. (1988). Generality of the effects of practice on social judgment tasks. Journal of Personality and Social Psychology, 54, 385-395.
- Smith, E. R., & Lerner, M. (1986). Development of automatism of social judgments. Journal of Personality and Social Psychology, 50, 246-259.
- Smith, E. R., Stewart, T. L., & Buttram, R. T. (1992). Inferring a trait from a behavior has long-term, highly specific effects. Journal of Personality and Social Psychology, 62, 753-759.
- Sorrentino, R. M., & Higgins, E. T. (1986). The "warm look". Introduction to R. M. Sorrentino & E. T. Higgins (Eds.), Handbook of motivation and cognition (Vol. 1). New York: Guilford.
- Sperling, G. (1960). The information available in brief visual presentations. Psychological Monographs, 74, Whole No. 498.
- Srull, T. K. (1981). Person memory: Some tests of associative storage and retrieval models. Journal of Experimental Psychology: Human Learning and Memory, 7, 440-462.
- Srull, T. K. (1984). Methodological techniques of the study of person memory and social cognition. In R.S. Wyer, Jr., & T. K. Srull (Eds.), Handbook of social cognition (pp. 73-150). Hillsdale, NJ: Erlbaum.
- Srull, T. K., Lichtenstein, M., & Rothbart, M. (1985). Associated storage and retrieval processes in person memory. Journal of Experimental Psychology: Learning, Memory, and Cognition, 11, 316-345.
- 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, 6, 841-856.
- Srull, T. K., & Wyer, R. S., Jr. (1989). Person memory and judgment. Psychological Review, 96, 58-83.
- Storms, L. H. (1958). Apparent backward association: A situational effect. Journal of Experimental Psychology, 55, 390-395.
- Strack, F., & Hannover, B. (1996). Awareness of influence as a precondition for implementing correctional goals. In P. M. Gollwitzer & J. A. Bargh (Eds.), The psychology of action (pp. 579-596). New York: Guilford.
- Stroop, J. R. (1935). Studies of interference in serial verbal reactions. Journal of Experimental Psychology, 18, 643-662.
- Taylor, S. E. (1991). The asymmetrical impact of positive and negative events: The mobilization-minimization hypothesis. Psychological Bulletin, 110, 67-85.
- Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. Psychological Bulletin, 103, 193-210.
- Taylor, S. E., & Gollwitzer, P. M. (1995). Effects of mindset on positive illusions. Journal of Personality and Social Psychology, 69, 213-226.
- Tice, D. M., Butler, J. L., Muraven, M. B., & Stillwell, A. M. (1995). When modesty prevails: Differential favorability of self-presentation to friends and strangers. Journal of Personality and Social Psychology, 69, 1120-1138.
- Tipper, S. P. (1985). The negative priming effect: Inhibitory priming by ignored objects. Quarterly Journal of Experimental Psychology, 37a, 571-590.
- Trope, T. (1986). Identification and inferential processes in dispositional attribution. Psychological Review, 93, 239-257.
- Turvey, M. T. (1973). On peripheral and central processes in vision: Inferences from an

PRIMING AND AUTOMATICITY RESEARCH

information-processing analysis of masking with patterned stimuli. Psychological Review, **80**, 1-52.

Uleman, J. S., Hon, A., Roman, R. J., & Moskowitz, G. B. (1996). On-line evidence for spontaneous trait inferences at encoding. Personality and Social Psychology Bulletin, **22**, 377-394.

Wasel, W., & Gollwitzer, P. M. (1997). We would if we could: Negative priming effects in stereotype suppression. Manuscript submitted for publication, University of Konstanz.

Wegener, D. T., & Petty, R. E. (1995). Flexible correction processes in social judgment: The role of naive theories in corrections for perceived bias. Journal of Personality and Social Psychology, **68**, 36-51.

Wegner, D. M. (1994). Ironic processes of mental control. Psychological Review, **101**, 34-52.

Wegner, D. M., & Bargh, J. A. (1997). Control and automaticity in social life. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), Handbook of social psychology (4/e). Boston: McGraw-Hill.

Wegner, D. M., & Erber, R. (1992). The hyperaccessibility of suppressed thoughts. Journal of Personality and Social Psychology, **63**, 903-912.

Wicklund, R. A., & Brehm, J. W. (1976). Perspectives on cognitive dissonance. Hillsdale, NJ: Erlbaum.

Wilson, T. D., & Capitman, J. A. (1982). Effects of script availability on social behavior. Personality and Social Psychology Bulletin, **8**, 11-19.

Winer, B. J. (1971). Statistical principles in experimental design (2/e). New York: McGraw-Hill.

Wyer, R. S., Jr., & Carlston, D. E. (1979). Social cognition, inference, and attribution. Hillsdale, NJ: Erlbaum.

Wyer, R. S., Jr., & Gordon, S. E. (1982). The recall of information about persons and groups. Journal of Experimental Social Psychology, **18**, 128-164.

Wyer, R. S., Jr., & Srull, T. K. (1989). Memory and cognition in its social context. Hillsdale, NJ: Erlbaum.

Zacks, R. T., & Hasher, L. (1994). Directed ignoring: Inhibitory regulation of working memory. In D. Dagenbach & T. H. Carr (Eds.), Inhibitory processes in attention, memory, and language (pp. 241-264). New York: Academic Press.

Table 1: Examples of Scrambled Sentence Tests

SCRAMBLED SENTENCE TEST

Instructions: For each set of words below, make a grammatical four word sentence and write it down in the space provided.

For example:

flew eagle the plane around

The eagle flew around.

* * * * *

(from Bargh, Chen, & Burrows, 1996, Experiment 2)

1. him was *worried* she always
2. from are *Florida* oranges temperature
3. ball the throw toss silently
4. shoes give replace *old* the
5. he observes occasionally people watches
6. be will swear *lonely* they
7. sky the seamless *grey* is
8. ate she it *selfishly* all
9. be to back *careful* better
10. prepare the gift wrap neatly
11. sew *sentimental* buy item the
12. he *wise* drops only seems
13. are we *stubborn* courteous sometimes
14. the push wash frequently clothes
15. us *bingo* sing play let
16. should now withdraw *forgetful* we
17. somewhat prepared I was *retired*
18. sunlight makes temperature *wrinkle*
raisins
19. is *rigid* he usually studying
20. a have *traditional* wedding holiday
21. picked throw apples hardly the
22. drink this looks seems *bitter*
23. they obedient him often meet
24. there are they *conservative* going
25. knits *dependent* he occasionally them
26. studies she texts *ancient* him
27. *helpless* it hides there over
28. is he *gullible* plant so
29. *cautious* alone very are they
30. send I mail it over

(from Chartrand & Bargh, 1996, Experiment 1)

1. from are Florida *preserve* they
2. a smile parrot what great
3. watches *recalls* he occasionally people
4. ball the hoop toss normally
5. saw hammer he train the
6. good dislikes *recognizes* she deals
7. maintain she to composure try
8. should withdraw *keep* now we
9. the machine wash frequently clothes
10. somewhat *memory* prepared I was
11. save does *study* usually he
12. be to *remember* back careful
13. sky the seamless red is
14. a have June holiday wedding
15. they *retain* him often meet

Note: Words in italics are the critical priming stimuli (for the “elderly” stereotype and the goal of memorization, respectively); they are *not* italicized in the actual task.

Table 2: Example of funneled debriefing procedure for supraliminal priming task

The experimenter proceeds to ask the participant the following questions, and records the answers given:

1. What do you think the purpose of this experiment was?
2. What do you think this experiment was trying to study?
3. Did you think that any of the tasks you did were related in any way?
(if "yes") In what way were they related?
4. Did anything you did on one task affect what you did on any other task?
(if "yes") How exactly did it affect you?
5. When you were completing the scrambled sentence test, did you notice anything unusual about the words?
6. Did you notice any particular pattern or theme to the words that were included in the scrambled sentence test?
7. What were you trying to do while reading the behavioral phrases on the computer monitor? Did you have any particular goal or strategy?

(Source: Chartrand & Bargh, 1996, Experiment 1)

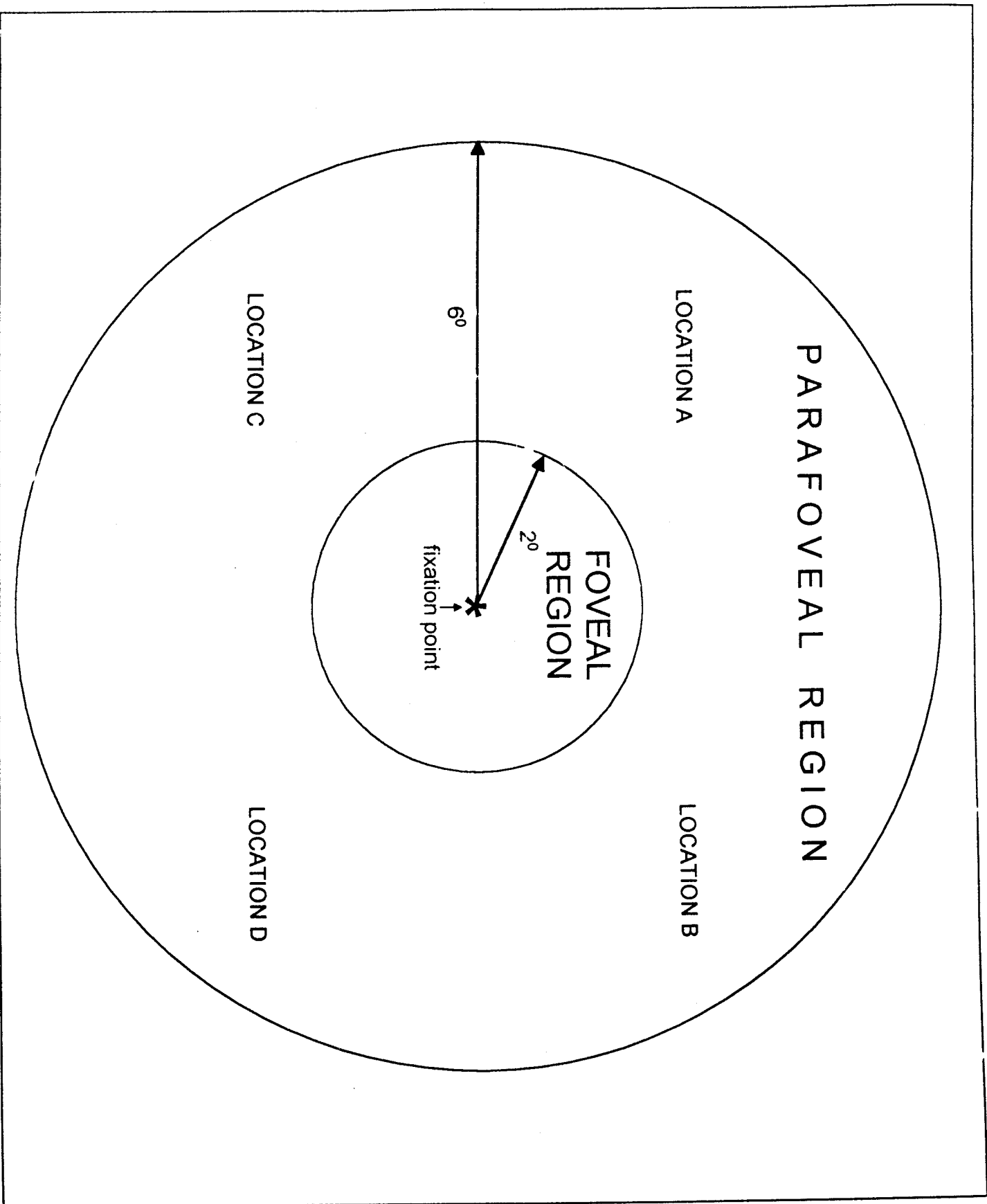
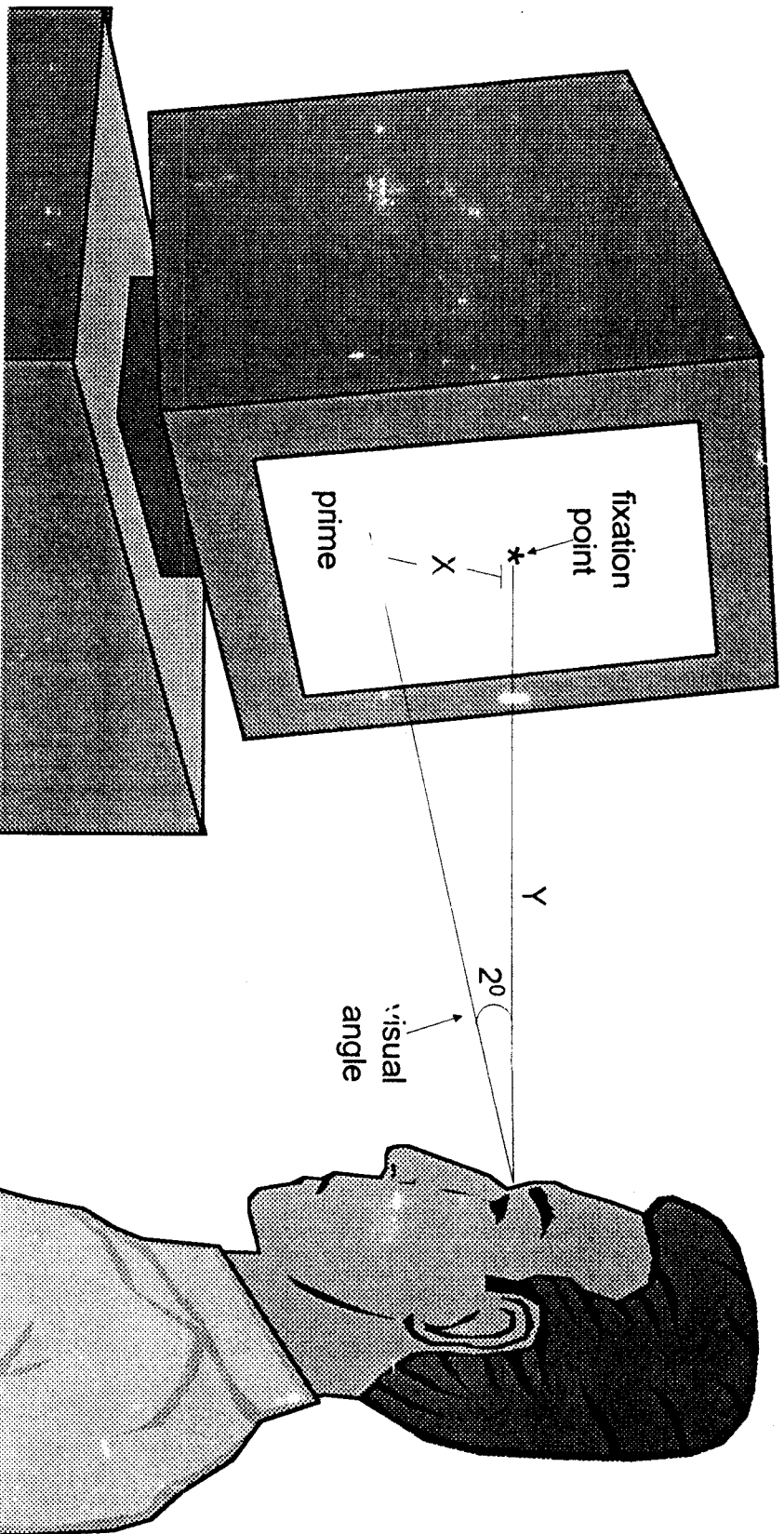


Figure 1. Subliminal priming: the foveal and parafoveal visual fields.



$$Y = X / \tan(20^\circ)$$

Figure 2. Determining the parafoveal region of the computer display and calculating the required distance of the participant from the computer screen.

SEQUENTIAL PRIMING PROCEDURE

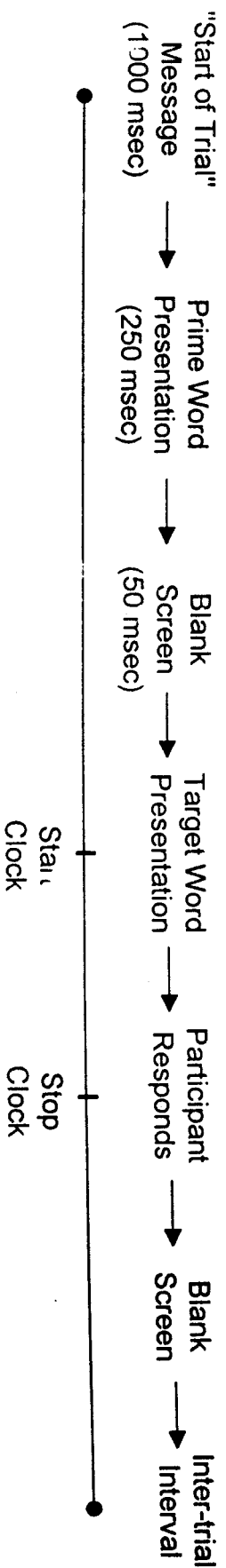


Figure 3. The sequential priming paradigm.