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Central activation of the sexual system

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Chapter 5

Conscious Processing of Sexual Information: Interference Caused by Sexual Primes

The concept Sexual Content-Induced Delay (SCID) refers to a hesitancy in decision-making related to erotic material (Geer & Bellard, 1996; Geer & Melton, 1997). Empirical evidence about SCID stems from lexical decision tasks. Our previous studies also showed SCID effects in sex versus neutral categorization tasks in which pictures were used. In these tasks recognition of sexual pictures is delayed when preceded by consciously presented sexual primes. In the current study two manipulations were added to the categorization task to investigate underlying information processing mechanisms of SCID. Firstly, the appraisal process was influenced by varying the instructions. Secondly, primes with nonsexual emotional content were added to test the specificity of the SCID effect. Thirty-seven undergraduates participated in the experiment and were asked to categorize sexual and neutral pictures that were primed by sexual, threatening, and neutral primes. Participants ignored or focussed prime content dependent on two different instructions. Results showed that the SCID effect only emerged when sexual primes were ignored, however, threatening primes also decelerated recognition of sexual pictures after the ignore instruction. Results of the focus instruction were qualitatively different, that is, participants recognized sexual pictures faster when primed sexually. It was suggested that SCID can be interpreted as the activation of regulatory modules by emotional stimuli in the stage of elicitation of emotional response. In contrast, when the sexual system is already activated, it appears that decisions regarding sexual information are facilitated.

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Introduction

The concept Sexual Content-Induced Delay (SCID) was introduced by Geer and colleagues (Geer & Bellard, 1996; Geer & Melton, 1997; see also Geer & Manguno-Mire, 1996). It refers to a hesitancy in decision-making related to erotic material and in a broader sense to the specific aspects of processing sexual information. Empirical evidence for the SCID phenomenon was found in unprimed (Geer & Bellard, 1996) and primed (Geer & Melton, 1997) lexical decision tasks. In a study from our laboratory, which was designed to investigate appraisal of sexual pictures, we found a delay in recognition of sexual "target-pictures" caused by preceding conscious sexual "prime-pictures" (Chapter 4). This effect is similar to SCID. Furthermore, this priming paradigm may be suitable to answer unresolved problems concerning underlying mechanisms of SCID.

The experiment conducted by Geer and Bellard (1996) examined SCID in a very clear way. In an unprimed lexical decision task participants were asked to decide if letter strings formed a word "yes or no." Sexual and neutral words were used. For the control condition these words were scrambled into nonwords. Decisions on sexual words were slower compared to decisions on neutral words. In a primed lexical decision task Geer and Melton (1997) further explored SCID. Decisions on sexual and neutral words (vs. decisions on nonwords) were preceded by sentences that ended with a double entendre word (e.g., *screw, pussy*). These sentences had either an erotic or a neutral biasing context. As expected decisions were facilitated when the context of the priming sentence and the meaning of the target word were congruent. More interestingly, when sentence context and target word were both neutral, decisions were faster compared to conditions in which either the target word, the sentence context, or the combination was sexual. These last three conditions, all containing sexual information, did not differ from each other. These studies showing longer response latencies when sexual information is involved make up the empirical basis for the SCID phenomenon (Geer & Bellard, 1996; Geer & Melton, 1997). Other relevant studies involving SCID can be found in a review by Geer and Manguno-Mire (1996).

What is the underlying mechanism causing SCID? Geer and Melton (1997) provided two hypotheses. The appraisal hypothesis states that the delayed response is the result of cognitive appraisal of emotional stimuli

calling on additional processing. This interferes with the decision making process (cf. Pashler, 1994). The response bias hypothesis states that when a decision about social unacceptable stimuli is made, responses are delayed because participants do not want to make an error (Geer & Melton, 1997). Up to now the data do not support one hypothesis over the other.

SCID could also be placed in the "Information Processing Model of Sexual Arousal" introduced by Janssen et al. (2000). In this model activation of the sexual response is viewed as an interaction of automatic and controlled cognitive processes. In a first stage a sexual stimulus automatically activates the "sexual system" whereafter conscious appraisal of the stimulus triggers controlled, regulatory processes. To test this model Janssen and colleagues asked participants to categorize sex and neutral, that is, "plant," target slides that were preceded by sex or plant priming slides. The primes were presented subliminally, so that effects of the primes could be attributed to automatic processes. It was predicted that sexual primes would facilitate categorization of sexual targets. However, the manipulation of subliminal presentation failed for some participants, so that they afterwards could recognize primes above chance. Therefore, the group was split in "high recognizers" versus "low recognizers," related to the level of awareness at which sexual information was processed. As predicted, sexual primes facilitated categorization of sexual targets for the low recognizers. Surprisingly, the high recognition group revealed a negative priming effect; categorization of sexual targets was *decelerated* by sexual primes. Thus, the activation of regulatory processes resulted in similar SCID effects as found by Geer and colleagues.

The interpretation that regulatory processes were responsible for the SCID effect is highly speculative. Firstly, the group of high recognizers was very small. Secondly, to be sure that controlled processes are responsible, the primes should be presented to allow participants to be fully aware of stimulus content. In a sequel to this study (Chapter 4), we changed the design, presenting all the primes consciously, for 1000 ms. Categorization of sexual targets was now slower when the preceding prime was a sexual picture compared to a preceding neutral (i.e., plant) picture. This finding has been interpreted as a SCID and it provides convergent validation of this concept. SCID occurs not only in verbal material, as in the lexical decision tasks (Geer & Bellard, 1996; Geer & Melton, 1997) but also in the processing of visual information. Two findings of this study (Chapter 4) did

not support the hypotheses about the underlying mechanism of SCID. Categorization of plant targets was not dependent on the content of the primes (sex vs. plant). This contradicts the Geer and Melton (1997) appraisal hypothesis, which would predict that sex primes would decelerate all subsequent decisions. Furthermore, the difference between plant-primed plant targets and plant-primed sex targets was not significant. This contradicts the response bias hypothesis, which would predict sex targets to be categorized slower. Sexual information might trigger regulatory modules that are specific for sexual response. Because specific regulation does not affect neutral responses, sex primes do not interfere with plant targets. This interpretation can be seen as an elaboration of the appraisal hypothesis of Geer and Melton (1997).

To explore further the role of appraisal in the explanation of SCID we used the original design of our previous study (Chapter 4) and added a manipulation of instruction. In the previous study, participants were simply asked to categorize the second slide that was presented. In this design it remains unclear how participants handled the information provided by the primes. In a nonemotional priming task, Zeelenberg, Pecher, De Kok, and Raaijmakers (1998) made two instructions that slightly differed on how much attention is paid to the primes. This manipulation appeared to have a crucial influence on the priming effect. Inspired by this, the sex/plant categorization task was repeated under two different instructions. In one version, participants were asked "to ignore the content of the first picture (i.e., prime) and respond to the second one (i.e., target)." In the other version, participants were asked "to focus on the first picture, although the decision to make refers to the second picture."

The ignore instruction mostly resembles our previous study (Chapter 4). Therefore, it was predicted that the SCID effect would be replicated here. It is difficult to predict the effect after the focus instruction. When emotional valence of the primes is the key agent, SCID might be strengthened because of more intensive appraisal. On the other hand, when a different pathway is activated by increased attention to the primes, SCID might disappear.

In our previous study (Chapter 4), the content of the sexual primes was varied, that is, romantic versus explicit, in line with the work of Geer. SCID was found to be most prominent on the explicit slide-set, although the romantic slides elicited the highest level of sexual arousal (i.e., subjective assessments measured in a separate task). This finding lead us to think that

emotional valence rather than *sexual* valence might be responsible for SCID. In addition, appraisal theory would predict that any emotional category would require additional processing and thus induces a SCID-like phenomenon (Lazarus, Kanner, & Folkman, 1980). This hypothesis was also tested in the current study. Threatening primes were added to the categorization task. Participants were asked to categorize sex and plant pictures as quickly as possible. These pictures were primed by a sex, a plant, or a threatening picture that was presented for 1000 ms. When both sex and threatening pictures decelerate decisions on sexual targets, emotional valence in general can be held responsible for the delay.

Method

Participants

Thirty-seven undergraduates participated in the experiment to fulfill a course requirement. All completed written informed consent prior to participation. The data of four participants were excluded, three because of excessively high error rates ($> 20\%$), one because of extremely slow responses ($M > 1500$ ms), leaving the sample size to 33 participants, 22 men and 11 women ($M = 22.3$ years, $SD = 3.1$).

Apparatus

A Macintosh PowerPC plus monitor was used for stimulus presentation and data collection. Images with a size of 10 cm x 10 cm were presented on a black background; viewing distance was approximately 60 cm. For the registration of responses a button box with two buttons was placed in front of the participant. One button was labeled with the word *sex*, the other with the word *plant*. The position (left/right) of these buttons was randomly varied between participants.

Three kinds of pictures were presented: *threat*, *sex*, and *plant*. Threat pictures consisted of threatening images of angry, mutilated, or dead people. Pictures with sexual content portrayed nude female models and heterosexual couples engaged in oral or genital sexual activity. The neutral, plant set, depicted pictures of plants and bushes. Pictures were selected from The International Affective Picture System (Lang, Öhman, & Vaitl, 1988), downloaded from the internet, or digitized from slides used in earlier sex-research experiments (Chapter 2; Janssen et al., 2000). All pictures were

carefully selected to match on stimulus dimensions as complexity, contrast, and luminance. This selection was based on objective criteria. For example, the number of main elements of a picture may not exceed two, very dark or light pictures were adjusted by computer, and it was tried to accomplish a broad range of colors for all sets. Final decisions were based on subjective assessments, however.

Two kinds of instructions were used (cf. Zeelenberg et al., 1998) In the *focus* instruction participants were asked to pay attention to the first picture they will see and to categorize the second picture. In the *ignore* instruction participants were asked to ignore the first picture they will see and to categorize the second picture. Participants were asked to respond as quickly as possible by pushing either the sex or plant button in front of them. Targets (sex or plant) were primed by preceding pictures (sex, threat, or plant) that were presented for 1000 ms. There was no interstimulus interval. Decision time was measured from onset of the target to the pressing of a button. Target presentations ended at participant's responding, afterwards 1000 ms the next trial (i.e., prime-target combination) started.

A $3 \times 2 \times 2$ (Prime \times Target \times Instruction) factorial design with repeated measures was employed. The variables Prime and Target were operationalized by 40 threatening, 100 sexual, and 100 neutral pictures. There were two blocks of 60 trials that were preceded by either the ignore or the focus instruction. With regard to the factors, Prime and Target, the total collection of pictures was randomly split up in 120 primes, that is, 40 sex, 40 threat, and 40 plant, and 120 targets, that is, 60 sex and 60 plant. Two blocks of 60 trials were formed each containing 10 trials per condition (3 Prime \times 2 Target). The sequence of these trials per block was randomly set afresh for each participant. The two different instructions were coupled to the blocks, also six practice trials with different pictures were added. The sequence of the blocks with instruction added was alternated between participants.

Procedure

The session lasted about 30 minutes. The participants were tested individually. Participants were informed about the experiment and were asked to respond with their right- and left-hand index fingers. The experimenter went behind a draught-screen; further instructions were given by computer. After the participant signaled he/she was ready, the experimenter started a new block of trials. At the end an exit-interview was

administered, and the participants were provided with information about the hypotheses under study.

Results

Thirty-three participants completed a total of 3,960 trials. Outlier decision times were determined using the following procedure (cf. Mogg et al., 1992; Ratcliff, 1993). Firstly, 212 response errors were eliminated (i.e., participants pressed the sex-button in response to a plant target and vice versa). Secondly, decision times below 100 ms and above 4000 ms were excluded, after which decision times of three standard deviations above a participant's mean were removed. This procedure led to the exclusion of another 44 trials.

Analyses of variance (ANOVA) were performed on the trimmed mean decision times (see Table 5.1 and Figure 5.1). The Greenhouse-Geisser epsilon procedure was applied to correct for the violation of the sphericity assumption in repeated measures designs. A 3 (Prime) \times 2 (Target) \times 2 (Instruction) repeated measures ANOVA revealed three main effects: Prime, $F(2, 64) = 9.89, p < .01, \eta^2 = 0.9$; Target $F(1, 32) = 19.55, p < .01, \eta^2 = 1.0$; and Instruction $F(1, 32) = 14.07, p < .01, \eta^2 = 1.0$. Also all interactions between these factors appear significant: Prime \times Target $F(2, 64) = 5.53, p < .01, \eta^2 = 1.0$; Prime \times Instruction $F(2, 64) = 3.99, p < .03, \eta^2 = 0.9$; Target \times Instruction $F(1, 32) = 4.92, p < .04, \eta^2 = 1.0$; and Prime \times Target \times Instruction $F(2, 64) = 15.79, p < .01, \eta^2 = 0.9$.

To determine whether we replicated the SCID effect after the ignore instruction follow-up paired t tests were conducted. For this instruction, recognition of sexual targets was slower when preceded by sex primes compared to plant primes, $t(32) = 2.54, p < 0.02$. Paired t tests to investigate if sexual and threatening primes had differential effects revealed that for sex targets threatening primes did not differ from sexual primes, $t(32) = 0.79, ns$, and also decelerated responses compared to plant primes, $t(32) = 3.54, p < 0.01$. Regarding responses to plant targets for the ignore instruction there was no difference between sex and plant primes, $t(32) = 0.35, ns$, but responses after threatening primes were slower compared to plant, $t(32) = 2.97, p < 0.01$, and sex primes $t(32) = 3.15, p < 0.01$.

Table 5.1 Mean Decision Time (in ms) in a Categorization Task for Sex and Plant Targets by Prime Content and Instruction ($N = 33$)

Condition	Ignore		Focus	
	Instruction		Instruction	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Sex targets				
Plant primes	631	283	738	242
Sex primes	674	267	662	206
Threatening primes	687	248	722	208
Plant targets				
Plant primes	526	129	590	173
Sex primes	529	130	634	159
Threatening primes	564	134	650	185

The pattern of the mean responses to sex targets preceded by sex and plant primes after the focus instruction was reversed. Paired t tests showed that responses to sex targets were facilitated when primed sexually, $t(32) = 4.89, p < 0.01$. Responses to threatening primed sex targets were also slower compared to sex primed sex targets, $t(32) = 5.86, p < .01$, and did not differ from plant primed sex targets, $t(32) = 1.10, ns$. For plant targets after the focus instruction there was also a congruency effect. Decisions on plant primed plant targets were made faster than sex primed plant targets, $t(32) = 2.68, p < .02$, and threatening primed plant targets, $t(32) = 3.56, p < .01$. There was no difference between mean responses to plant targets after sex primes compared to threatening primes, $t(32) = 0.97, ns$.

Although we did not find any gender differences in the earlier study (Chapter 4) gender is an important factor in Geer's work (e.g., Geer & Manguno-Mire, 1996). Therefore, gender was added as between factor and we performed a 2 (Gender) \times 3 (Prime) \times 2 (Target) \times 2 (Instruction) repeated measures ANOVA on the mean decision times. There was no main effect of gender, and one significant interaction with this factor was found:

Gender x Target, $F(1, 31) = 5.69, p < .03$. Inspection of the means showed that the difference between responses to sex and plant targets was larger for men (men: sex targets 768 ms vs. plant targets 591 ms; women: sex targets 644 ms vs. plant targets 578 ms).

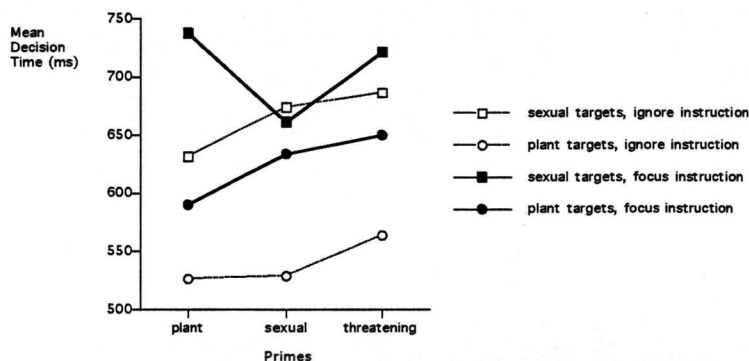


Figure 5.1. Mean decision time in a categorization task for sex and plant targets by prime content and instruction ($N = 33$).

Discussion

After the ignore instruction, decisions on sex targets were made slower when they were preceded by a sexual prime compared to decisions on neutral primed sex targets. This is a SCID and replicates the effect of our previous study (Chapter 4). Similar results were found for threatening and sexual primes with the sex targets/ignore instruction. Emotional valence rather than sexual valence could be responsible for the SCID effect. However, because sexual information can be appraised both, positive and negative, and no other positive primes (e.g., happy faces) were presented, it remains an interesting issue whether the SCID phenomenon will be manifest after presentation of clearly positive primes.

Regarding plant targets, SCID was not found; there was no difference between sex or plant primed targets after the ignore instruction. This is consistent with our previous study (Chapter 4) and supports the hypothesis that SCID can be seen as the activation of regulatory modules by emotional

(e.g., sexual) stimuli when an emotional (e.g., sexual) response is elicited. Although decisions on plant targets did not differ for sex and plant primes, threatening primes decelerated the categorization after the ignore instruction. Apparently, when a neutral decision is asked, threatening information prevails over sexual (and neutral) information and interferes with the response.

With respect to the focus instruction, outcomes are qualitatively different. Unexpectedly, a congruency effect was found. Decisions to congruent trials (i.e., plant primed plant targets and sex primed sex targets) were made faster than those to incongruent trials (i.e., plant or threatening primed sex targets and sex or threatening primed plant targets). Thus, the two instructions focus or ignore clearly result in opposite outcomes for sexual primes.

How can these different processing mechanisms be integrated in one model of activation of sexual response? Recently, Milliken, Joordens, Merikle, and Seiffert (1998) proposed a new theoretical model to explain negative (and positive) priming effects. This model integrates different traditional explanations and is helpful to gain more insight into mechanisms involved in this study. In their view, priming results from an attention system "deciding" whether a response to a target stimulus is "known" (old) or whether it must be "learned" (new). Response to a target categorized as old is retrieved directly from memory whereas response to a target categorized as new relies on perceptual analysis. When prime and target are congruent there are two different options depending on the amount of attention paid to the primes. In attended trials, the similarity of the target is presumed to facilitate its categorization as old. In ignored trials, the familiarity of the target is presumed to rule out its quick categorization as new, but at the same time it is an insufficient basis for its categorization as old. This ambiguity in the temporal discrimination process for ignored repetition trials is presumed to underlay negative priming.

To extrapolate this idea to an example with reference to sexual activation, one can imagine a sexually attractive person sending out a sexual signal. When you are engaged in a sexual interaction with this person, who is also your partner, this information is processed quickly. Sexual memory is already "on" and attention is focussed on sexual cues. When this person is your colleague and you are in a business meeting, your attention will be focussed on work, and the signal will have an ambiguous load. Therefore

classification of the stimulus as sexual will be made slower. The first example links with the focus instruction of this study and can be placed in a framework of spreading activation (Collins & Loftus, 1975). The second example corresponds with the ignore instruction of this study and can be seen as a continuation of Geer's work on SCID (Geer & Bellard, 1996; Geer & Melton, 1997).

Taken together, we think this study is valuable in two directions. Firstly, it fits with an information processing approach to human sexuality (Everaerd, 1995; Geer et al., 1993). By specifying the hypotheses under study in following experiments, activational mechanisms of sexual response can be analyzed more precisely. In addition, this priming approach might contribute to comparable paradigm's indirectly measuring sexual interest or memory (Abel et al., 1998; Wright & Adams, 1999). Secondly, there could be a clinical value. Like the emotional Stroop task (Williams, Mathews, & MacLeod, 1996), this paradigm might result in a noninvasive and objective way to discriminate between different patient groups. Priming effects after the focus instruction might be correlated with the sensitivity of the sexual system and test arousability. The SCID effect after the ignore instruction might be linked to cognitive interference, which plays an important role in sexual dysfunctions, such as psychogenic erectile dysfunction (Barlow, 1986).