Do Subliminal Stimuli Affect Dream Content? Methodological Issues and Empirical Data

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The present paper shortly reviews the literature on subliminal stimuli and dreaming. Points of criticism are the lack of formal analysis in some studies and the inadequate stimulus technique. The present study could not replicate the findings of Leuschner et al. (1994) regarding the influence of formal stimulus characteristics but support the view that subliminal stimuli affect thematic content of dreams. (Sleep and Hypnosis 1999;1:181-185)

Key words: subliminal perception, dreaming, masking procedure

INTRODUCTION

In 1917, P tzl has investigated the effect of subliminal presented stimuli on dreams (1). The process of subliminal perception is paradoxical: on the one hand, the person is not aware of the stimulus (or at least of some features of the stimulus) during the perception process, on the other hand, the stimuli should affect thoughts, feelings or behavior in some way in order to verify that perception has taken place. Some authors (2) suggested the term implicit perception similar to the phenomenon implicit memory . P tzl (1) presented complex pictures for a very short time (10 ms) and asked the participants to draw their recollections of what they have seen. On the subsequent morning, they drew pictures of their dreams. P tzl (1) found that stimulus elements which were not consciously remembered after the presentation occurred in the dream drawings. Although the findings were replicated by Fisher (3), several methodological shortcomings limit the significance of these findings, i. e. no control condition was introduced to control for base rates of stimulus elements in dreams, and often very broad definitions of stimulus incorporation were applied (e. g. transformations were allowed). Several controlled studies (4,5,6) also found an effect of subliminal stimuli on dreams, but Johnson and Eriksen (7) were not able to replicate these findings.

Recently, Leuschner and Hau (8) have shown that subliminal presented pictures affect drawings after free imagination periods and drawings of dreams and support the P tzl effect (see also 9). Although, they utilized a formal analysis of the drawings (similar to dream content analysis) and introduced a control condition (blank slide), several methodological issues limit the generalizability of their findings. First, — as previous researchers — their stimulus was presented by a tachistoscope (8 ms), i. e. after the exposure of the stimuli that screen was dark. Sperling (10) has shown that the complete visual information is available for about 150 ms to 200 ms (iconic memory). Therefore, modern researchers (e. g.11,12) used masking procedures to avoid this uncontrollable prolongation of the intended presentation time. Second, Leuschner et al. (9) did not analyze the drawings of conscious recollections after presentation in order to exclude participants who were aware of the measured stimulus qualities. Third, in statistical analyses, drawings — but not participants — were assumed to be statistically independent (e. g. increasing degrees of freedom from df = 60 to df = 1203; Table 1, (9).

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The present study was quite similar to Leuschner et al. s investigation (9), but differ in several aspects: the stimulus presentation was masked, participants who consciously perceived the stimulus characteristic of interest were excluded from analyses, and instead of a blank slide a control picture was utilized. The paper will focus on the effects on dreams, whereas the data concerning subliminal perception and free imagery will be presented elsewhere (13).

METHODS

Participants

Thirty-two psychology students (25 women, 7 men) participated in the present study. Their mean age was 25.6 5.2 yrs. The participation was voluntary and unpaid.

Stimulus Presentation

The pictures were presented on a computer screen (14 inches) for the duration of 30 Milliseconds (ms). Immediately after the stimulus, a black-white random pattern was shown for 200 ms. (mask). The software was written by Irtel (14). The presentation time was chosen accordingly to hman and Soares (11) who found almost non conscious recollections of the stimuli (phobic object) in their sample. The first stimulus was the color picture of Leuschner et al. (9), a collage of a beach scene with predominant triangle forms. The second stimulus was a color photo of a fruit stand on a market.

Picture Analysis

Two different kinds of stimulus characteristics had to be rated by external judges for each drawing: formal aspects and thematic aspects. For measuring triangles, the scoring rules of Leuschner and Hau (8) were adopted, i. e. measuring the number of closed triangles, open triangles and intended triangles. Since the second stimulus contains a lot of circles (e. g. apples, peaches), similar scales were developed to assess the number of circles and semicircles per picture. In order to measure thematic aspects, four sum scores were included. First, the number of objects which were present in the two stimuli (stimulus 1: volcano, bat, car, sharkfin etc. and stimulus 2: apple, peach, box etc.) was determined. Second, more general categories (concepts) were rated in a similar way, e. g. vehicles, nutriments. This was done to measure transformation effects.

Procedure

First, the participant who arrived between 5 p. m. and 7 p. m. completed a short questionnaire assessing age, gender and dream recall frequency. Then he/she was placed in front of a computer (single sessions). A written instruction informed the participant about the procedure. In the dark room, the person should focus a cross in the center of the screen, and a tone announced the stimulus presentation. After the presentation, the participant was asked to draw everything he/she had perceived. For this task, colored pencils were provided. Next, a free imagination period (see 9) was followed by drawing the images of that period. A second drawing of consciously perceived elements completed the session. The participants returned the next morning, told his/her dream(s) and drew the most important scenes. Afterwards, the person had another free imagination period and drew these images. The following six days, the participants kept a dream diary in order to record their dream experience and to draw the most important scenes of the dreams. After one week, the procedure was repeated using the other stimulus (balanced order).

All pictures were rated by a blind judge according to the scales described in the section picture analysis . 101 pictures were rated by a second independent judge in order to compute interrater reliability. Additionally, the recollection pictures were analyzed for the used colors. If more than one picture was drawn, means were computed for each subject. The statistical power was at maximum p = .60, so that no corrections were computed to avoid further reduction of power. Non-parametric tests for independent samples were applied in order to avoid reduction in sample size, i. e. including only persons who reported dreams in every condition and to take into account that the data were not normally distributed. Effect sizes were calculated according to the formula given by Cohen (15).

Table 1. Conscious perception of the presented stimuli[1]

Variable	Stimulus 1	Stimulus 2	Statistical test	
Closed triangles	8	3	z = 2.8	.048
Open triangles	14	6	z = 4.7	.015
Intended triangles	15	7	z = 4.5	.017
Circles	9	7	z = 0.3	.719
Semicircles	4	8	z = 1.7	.099
Objects (Stim. 1)	4	2		.336*
Concepts (Stim. 1)	5	3	z = 0.6	.225
Objects (Stim. 2)	0	1		.508*
Concepts (Stim. 2)	0	1		.508*

* Fisher s exact test
[1] Frequency of persons who draw at least one of the form/object after presentation

Table 2. Comparison of dream drawings of the morning after presentation

Variable	Stimulus 1	Stimulus 2	Statistical test	p=	Effect size
Closed triangles	0.78 – 0.80	0.85 – 1.26	z = 0.4	.6377	d = -0.07
	(N = 13)	(N = 13)			
Open triangles	3.92 – 4.36	2.13 – 2.40	z = 0.8	.2037	d = 0.51
	(N = 10)	(N = 13)			
Intended triangles	1.22 – 0.97	1.89 – 2.71	z = 0.0	.5000	d = -0.33
	(N = 9)	(N = 13)			
Circles	8.36 – 11.88	2.69 – 2.14	z = 1.6	.9470	d = 0.66
	(N = 17)	(N = 10)			
Semicircles	1.39 – 1.84	1.70 – 2.06	z = 0.3	.3880	d = -0.16
	(N = 17)	(N = 10)			
Objects (Stim. 1)	0.18 – 0.35	0.05 – 0.18	z = 1.2	.1218	d = 0.47
	(N = 16)	(N = 13)			
Concepts (Stim. 1)	1.23 – 1.14	0.81 – 1.20	z = 1.0	.1579	d = 0.36
	(N = 16)	(N = 13)			
Objects (Stim. 2)	0.00 – 0.00	0.12 – 0.29	z = 2.0	.0223	d = -0.59
	(N = 17)	(N = 13)			
Concepts (Stim. 2)	0.09 – 0.26	0.08 – 0.15	z = 0.6	.7191	d = 0.05
	(N = 17)	(N = 13)			

Statistical test: Mann-Whitney-U-test (df=1, one-tailed)

RESULTS

17 persons reported at least one dream the day after the presentation of stimulus 1 and 13 persons after presentation of stimulus 2. When all dreams over the one-week period (mean 3.14 – 1.58 dreams per week) were averaged, the data of 30 persons (Stimulus 1) respectively 28 persons (Stimulus 2) could be included in the analysis. The interrater reliability (Spearman-Rank correlations) ranged from r = .723 (closed triangles) to r = .844 (circles), except for intended triangles (r = .528) and semicircles (r = .501). Whereas reliability was acceptable for three thematic

Table 3. Comparison of all dream drawings

Variable	Stimulus 1	Stimulus 2	Statistical test		Effect size
Closed triangles	1.01 – 1.67	0.92 – 1.72	z = 0.4	.3594	d = 0.06
	(N= 22)	(N= 28)			
Open triangles	4.60 – 4.89	4.37 – 4.22	z = 0.0	.4953	d = 0.04
	(N= 17)	(N= 28)			
Intended triangles	4.53 – 5.51	4.84 – 4.36	z = 0.5	.6887	d = -0.06
	(N= 16)	(N= 28)			
Circles	6.51 – 9.88	4.15 – 5.02	z = 1.5	.9312	d = 0.31
	(N= 30)	(N= 21)			
Semicircles	1.58 – 1.64	1.43 – 1.30	z = 0.1	.5384	d = 0.10
	(N= 30)	(N= 21)			
Objects (Stim. 1)	0.19 – 0.30	0.10 – 0.19	z = 1.2	.1136	d = 0.36
	(N= 26)	(N= 28)			
Concepts (Stim. 1)	1.03 – 0.68	0.90 – 0.79	z = 0.7	.2335	d = 0.18
	(N= 25)	(N= 28)			
Objects (Stim. 2)	0.00 – 0.00	0.03 – 0.08	z = 2.1	.0189	d = -0.53
	(N= 30)	(N= 27)			
Concepts (Stim. 2)	0.12 – 0.17	0.09 – 0.17	z = 0.4	.8161	d = 0.18
	(N= 30)	(N= 27)			

Statistical test: Mann-Whitney-U-test (df =1,one-tailed) variables (r = .746 to r = 1.00), it was very low for the variable Concepts of Stimulus 2 (r = .342).

In Table 1, the frequency of persons who drew a particular characteristic of the stimulus after the presentation in one of the two conscious recollection drawings is depicted. The comparison showed that triangles were more often drawn after the stimulus with triangles, i. e. this stimulus characteristic was not subliminal for all participants. On the other hand, thematic aspects were not recognized by the persons. The predominantly colors of stimulus 1 (green, blue) were more often used after its presentation. Therefore, color was not subliminal either. For subsequent analyses, persons who recognized a specific stimulus characteristic were excluded. The comparison of the dream drawings after stimulus 1 and after stimulus 2 revealed that formal characteristics did not differ (except for open triangles) whereas more clear differences in the expected direction were found for the thematic categories (Table 2). For intended triangles and especially for circles, the findings were contrary to the expectation. Although only one variable (objects of stimulus 1) reached significance, the effect sizes of the thematic aspects, except for concepts of stimulus 2, were medium (15). Analyzing the averages of all dream drawings led to similar results (Table 3).

DISCUSSION

The results support the hypothesis that subliminal stimuli affect to a limited amount dreams of the following night. However, the phenomenon was more pronounced for thematic aspects than for formal characteristics. The lack of effect on the Concepts of Stimulus 2 variable may be explained by its low reliability. This is in contrast with Leuschner et al. s study (9) in which the formal aspects (triangles) were more often found in drawings after stimulus presentation. Since triangle forms were the least subliminal, it seems plausible that the lack of analyzing the conscious recollections pictures and the inclusion of persons who consciously perceived a triangle may have biased their results. Therefore, it seems essential for future studies to use masking techniques. The exposure time (30 ms) was even long enough for some subjects to recognize forms and colors, and earlier positive research findings (exposure time plus 150 ms to 200 ms iconic memory time) may due to conscious recognition of some part of the presented stimuli. To evaluate the present findings, one has to keep in mind that sample size was small and significance was seldom reached. But effect sizes for thematic variables ranged from small to medium, so it will be valuable to investigate the phenomena in a more detailed way. It may be fruitful to use multiple subliminal presentations to strengthen the effect on subsequent mental processes and to determine individual thresholds for subliminal perception by forced-choice methods (e. g. 16). Since Strauch and Meier (17), for example, have shown that emotional charged presleep stimuli were more effective in influencing dream content than neutral stimuli, it will be interesting to use subliminal stimuli which are emotional charged. Although researchers have not shown effects of subliminally perceived stimuli on complex behavior such as purchasing (e. g. drinking Coca cola; cf. (18), hman and Soares (11) have demonstrated that phobic objects affect persons physiological processes even if they were not consciously recognized. The investigation of the incorporation of subliminal stimuli may contribute to a theory of dreaming, i. e., stimulate the development of a dream formation model which includes all sorts of waking-life perceptions (subliminal as well as consciously perceived) and stimuli which are present during sleep.

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