

Subliminal Perception and its Effects on Decision Making and Problem Solving

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Abstract

The research on Subliminal Perception and its Effect on Decision Making and Problem Solving is a true between subjects experimental design. 20 subjects were randomly allocated in the Control and Experimental Group each to study the influences of repeated Subliminal Priming through a subliminal stimulus presented at the rate of 0.02 seconds at an interval of 2 seconds for a duration of 20 seconds respectively in Colour and Shape Recognition Tasks. The results were collected for the Lexical Decision Making Task to measure forced choice decision making, and Anagrams to measure Problem Solving Abilities. Subliminal perception occurs when a stimulus is presented which is below the subjective level of human threshold of conscious processing, but passes through the objective threshold thus aiding in sensory discrimination of the stimulus. Subliminal Priming is a visual masking technique in which exposure to a stimulus influences the response to a later stimulus. The results of this study indicate that Subliminal Perception affects Decision Making as well as problem solving, and the results are significant at a confidence interval of 95%. The power of the test is 1, which shows that the results are accurate. The large effect size indicates that the difference is large between the Control and Experimental Groups. However, a gender difference in subliminal perceptivity is not seen.

Keywords: Subliminal Perception, Subliminal Priming, Priming Effects, Decision Making, Problem Solving,

The Mysteries of the Human Mind

Psychology aims to understand the human mind. But haven't we all asked questions in our life pertaining to if what we objectively perceive is all that is to reality? After all, our forefathers of Psychology have believed of concepts such as The Collective

Unconsciousness, the Anima-Animus and forces that govern us in our life or form a core of our beings. The consciousness of the human mind has several levels, as we perceive information in different levels as well. According to Hasher and Zacks (1984) individuals can register information about the frequency of events without consciously being aware of the conscious information processing.

We are humans whose eyes are too slow to see a flower bloom and science has redefined our existence through tools that answer questions of the microcosms and the macrocosms. The beautiful rainbow that we see is unbelievably just a fraction of the scatter of wavelengths in the electromagnetic spectrum. Our objective perception has been deduced to a frame rate where we cannot follow a baseball pitch as a high speed camera. But can information that does not enter our depth of perception still influence us? One of the most long-standing unresolved issues within modern psychology concerns whether it is possible to “perceive information even when we do not have the subjective experience of perceiving” (Merikle and Joordens, 1997, p. 219). At times referred to as “unconscious perception” (Merikle and Reingold, 1992, p. 56), “perception without awareness” (Bornstein, 1992, p. 3), or “knowing without knowing” (Masling, 1992, p. 259), the study of subliminal perception research has a long and tumultuous history within academic psychology (Dixon, 1971, 1981; Erdelyi, 1985, 1996, 2004a; Eriksen, 1960; Holender, 1986; Merikle, 1992).

Subliminal Perception

Subliminal Perception is said to occur as the result of a stimulus that is below the limen of our Objective Conscious Perception but influences our cognition, affect and behaviour. Since the 1950's, subliminal perception has been seen as psychological mystery. Subliminal perception happens when weak stimuli are perceived without the human's awareness (Dixon 1971). Merikle (1998) saw that the memory of events during general anaesthesia is often long lasting and highly impactful. "There are hundreds of indications leading us to conclude that at every moment there is in us an infinity of perceptions, unaccompanied by awareness or reflection... (p. 53). The choice we make arises from these insensible stimuli, which, mingled with the actions of objects and our bodily interiors, make us find one direction of movement more comfortable than the other" (Leibniz, 1981, p. 166).

Seminal writings of Johan Friedrich Herbart (1776-1841) on Subliminal Perception was found during the infant years of empirical psychology. Zajonc (1980) first demonstrated that even subliminal exposure to a stimulus enhances one's attitude towards this stimulus. The aim of this research problem is to study the effect of Subliminal Perception on Decision Making and Problem Solving. Popular interest in this field was spurred by the claims of a marketing researcher, James Vicary (Merikle, 2000). Vicary claimed to have presented an advertising message “Eat Pop Corn and drink Coca Cola” for 3 milliseconds during the course of a movie, which participants were consciously unaware of. However, the significant rise in their purchase of these two products were significant which implied that these messages had a reinforcing impact on their behavior.

Subliminal Priming

Priming refers to a increased sensitivity to certain stimuli due to prior experience. Because priming it believed to occur outside of conscious awareness, it is different from memory that relies on the direct retrieval of information. Direct retrieval utilizes explicit memory, while priming relies on implicit memory. Research has also shown that the affects of priming can impact the decision-making process (Jacoby, 1983). Priming is therefore an ideal manner of studying the behavioral influence of unconscious stimuli, and subliminal priming has indeed been applied in many psychophysical studies so far. Many studies today demonstrate such activation of goals by examining the effects of “priming” participants to feel a certain way and having participants make “choices.” Findings show that primed participants will respond consistently with the primes to which they were exposed (Strahan, Spencer, & Zanna, 2002; Winkielman, Berridge, & Wilbarger, 2005).

Subliminal Perception Affects Human Cognition and Behavior

Newell, B.R, Shanks, R.D, “Unconscious influences on decision making: A critical review” presents three research studies in which unconscious factors have been studied: multiple-cue judgment, deliberation without attention, and decisions under uncertainty. Hassin et al. (2007) primed their participants with a brief (16-ms) masked presentation of either the Israeli flag or a scrambled version of the flag, prior to each of several questions about political attitudes (e.g., “Do you support the formation of a Palestinian state?”) and voting intentions which showed that subliminal primes also affected subsequent voting decisions in the Israeli general elections.

Eckstein. D, Norris. D, Matthew. H.D, “Can subliminal signal affect human’s judgment and decision-making?” produced results which showed that even though participants receive visual and auditory information that is beyond their awareness, they are influenced by the prime while making decisions. Pessiglione et al. “Subliminal Perception and Priming Responses” demonstrated that one aspect of task setting motivation could be cued subliminally. Schlaghecken and Eimer (2004) showed that subliminally presented arrows biased participants’ responses in trials in which they could freely choose which among two buttons to press (e.g., left vs. right key-press). The authors concluded, then, that the effect of subliminal primes on free choice can be obtained only when the appropriate stimulus–response mapping is consciously active and rehearsed (Kiesel, Wagener, Kunde, Hoffmann, and Fallgatter, 2006; Klapp and Haas, 2005).

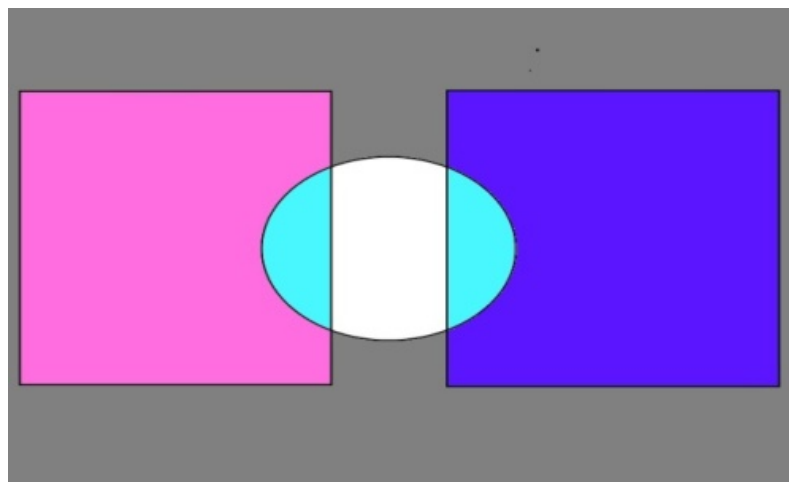
Subliminal Perception can be said to occur in our everyday lives, through Media Projections etc. Subliminal Stimuli is said to affect thoughts, behaviour, emotions and actions. The power of the Subliminal is directly related to decision making, attitudes, and consumerism. However, Subliminal Stimuli in relation to Problem Solving has not been studied till date. This study is aimed at deciphering the effect of Subliminal Perception on Decision making, and as well as Problem Solving.

Research Design and Methodology

The study on Subliminal Perception and its Effect on Decision Making and Problem Solving was carried out in a Between Subjects Group Design through Purposive Sampling, with 20 participants each in the Experimental and the Control Group. It was assumed that Subliminal Priming will affect Decision Making Responses. One way to test the effect of Subliminal Perception is to use the masked repetition priming paradigm, which has become a dominant tool in the investigation of early cognitive and emotional processes (Bargh, 1998; Dixon, 1971, 1981; Forster and Davis, 1984; Marcel, 1983). The Subliminal Primes were masked visual stimuli presented as numbers-9, 15, 2, 7, 11 in the Color Recognition Task. The human cognitive system can process subliminal information, and meaningful single units (e.g., words, numbers) can even be processed semantically (Kouider and Dehaene, 2007; Van den Bussche, den Noortgate, and Reynvoet, 2009). The Subliminal Primes presented in the Shape Recognition Task were the words Team, Read, Art, Tea Pear. The subliminal stimulus are presented at a rate of 0.02 seconds at an interval of 2 seconds.

The Decision Making Task was a Self Constructed Lexical Decision Making Task where the participant had to choose a number presented with three alternatives between 0 to 20. The Problem Solving Task presented 5 word anagrams to be solved, each of 3-5 alphabet length. The alphabets of the stimulus words were presented nonsensically on each picture as the target letters of the anagram to be solved. The participants were given 3 seconds for each response, and the first word that came to the subject's mind was recorded as the answer. It was assumed that the subliminal primes will influence the responses for both the decision making and problem solving tasks. The dependent variables-Decision Making and Problem Solving had been measured by the percentage of hits for the two sets of subliminally primed stimulus in the forced choice decision making and problem solving tasks.

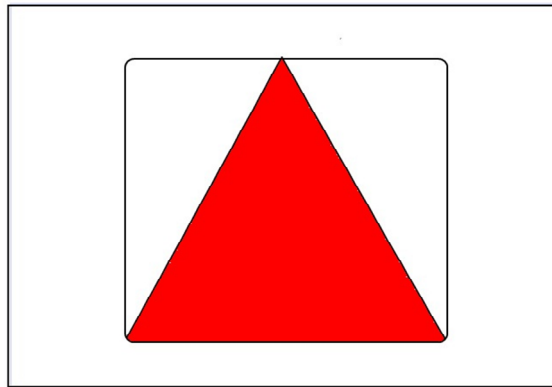
Appendix1 : A slide of the Colour Recognition Task where subjects were asked the colour of the center of the object placed at the center, where the subliminal primes were projected.



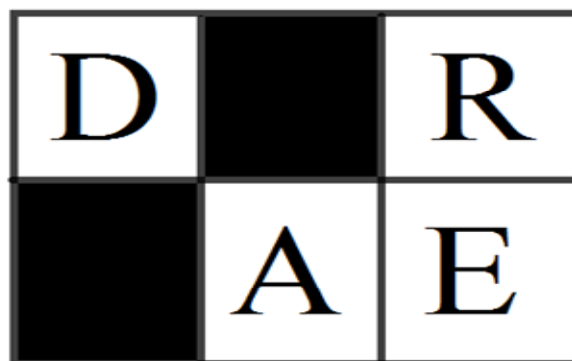
Appendix 2: A slide from the lexical decision making task. The subliminal Prime presented was 13.

13 7 6

Appendix 3: Shape Recognition Task where participants were asked the shape of the object at the center siultaneously subliminal primed.



Appendix 4: A slide from the problem solving task. Answers are Dare, Dear and Read but the Subliminal Prime for this anagram is Read. Each subliminal word prime can be rearranged to form two other alternatives.



Results and Findings

The Subliminal Primes were masked visual stimuli presented in the Colour and Shape Recognition Tasks. The Data collected was analyzed in the form of Hits and

Omissions, with reference to the Signal Detection Theory. The Percentage of Hits was higher in the Experimental Group for Decision Making (74>23) and the Percentage of Hits is also higher in the Experimental Group for Problem Solving (85>32) when Subliminal Stimulus is presented to the Experimental Group.

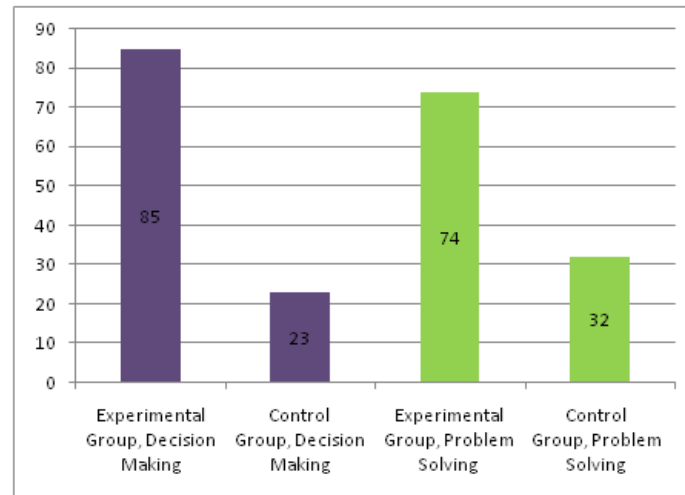


Figure 1 showing the number of hits for the Subliminally Primed Stimulus by the 2 groups on Decision Making and Problem Solving.

Multivariate Analysis of Variance was used for analyzing and interpreting the data further. Box's M was insignificant as $p = 0.928 < \alpha 0.001$ indicating that there were no significant differences between the covariance matrices.

Table1: Table showing Levine's Test of Equality of Error Variance

Levene's Test of Equality of Error Variances ^a				
	F	df1	df2	Sig.
Hits Decision Making	.123	1	38	.727
Hits Problem Solving	.031	1	38	.861

In reference to Table 1, the assumption of equality of variances has not been violated by both the dependent variables-Decision making and Problem Solving for both the dependent variables, Decision Making ($p=7.27>0.05$) and Problem Solving ($p=8.61>0.05$) as calculated by the Levene's Test of Equality of Error Variance.

Table 2: Multivariate Test and values for Pillai’s Trace and Wilk’s Lambda

Multivariate Tests ^c									
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Intercept	Pillai's Trace	.955	3.967E2 ^a	2.000	37.000	.000	.955	793.366	1.000
	Wilks' Lambda	.045	3.967E2 ^a	2.000	37.000	.000	.955	793.366	1.000
group	Pillai's Trace	.855	1.091E2 ^a	2.000	37.000	.000	.855	218.275	1.000
	Wilks' Lambda	.145	1.091E2 ^a	2.000	37.000	.000	.855	218.275	1.000

With reference to Table 2, the Wilk’s Lambda Test with the alpha at 0.05 gives the multivariate $\eta^2=0.855$ indicated that approximately 29.24% of the differences between Decision Making and Problem Solving is associated with Subliminal Priming. Test of Between Subjects Effects gave us the p-values indicating that Subliminal Perception affects decision making ($p=.000$, $df=1$) and problem solving ($p=.000$, $df=1$) with an observed power of 1, at the 0.05 level of significance.

Thus, this study concluded with the results that correlate with the hypothesis stating that Subliminal Perception affects Decision Making as well as Problem Solving at a confidence of 95%, at an observed power of 1. The Partial η^2 indicated a large effect size referring to the large differences between the Control and Experimental Group in the percentage of Hits for the Subliminally Primed Stimulus. Chance factors could not have led to such a large discrepancy in the scores between the Experimental and the Control group.

Table 3: The Test of Between Subjects Effects

Tests of Between-Subjects Effects										
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	Significant at: Partial Eta squared		Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
group	hitsDM	78.400	1	78.400	.000	.740	108.335	1.000		
	hitsPS	81.225	1	81.225	.000	.754	116.254	1.000		
Error	hitsDM	27.500	38	.724						
	hitsPS	26.550	38	.699						
Total	hitsDM	366.000	40							
	hitsPS	427.000	40							

Thus, the Subliminal Stimuli which was reported as ‘invisible’ or ‘something blinking’ in the post ask questions had an influence over the individual’s decision making and problem solving, by giving the same response as the primed stimulus in a list of other alternatives. Test of Between Subjects Effects (Table 3) gives the mean

square of the hits of Decision making (78.400) and Problem Solving (81.225) which is significant at the 0.05 level ($p=0.000$). The p -values tell us that Subliminal Perception affects decision making ($p=0.000$, $df=1$) and problem solving ($p=0.000$, $df=1$) with an observed power of 1.

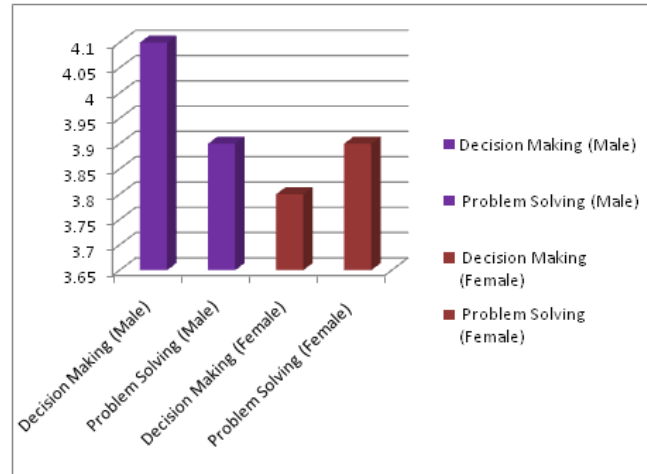


Figure 2: Means of hits in Decision Making and Problem Solving by Male and Female participants respectively as a measure of gender differences.

A t-test was carried out to study the gender differences which indicated that there is no gender differences in Subliminal Perception ($F=0.31$, $df=18$, $p=0.464 > 0.05$).

A meta-analysis by Bornstein (1989) reviewed the exposure-affect relationship among studies examining the mere exposure effect between 1968 and 1987. He found that the exposure effect is enhanced when using brief presentations of the stimulus in a heterogeneous exposure sequence. Thus, the results of this study could be attributed to the presentation of the Subliminal Stimulus at a rate of 2 millisecond at an interval of 2 seconds. This repetitive priming gives the strongest of effects. The fact that the data was collected immediately after the presentation of the sets of Subliminal Stimulus could also aid to the accuracy of results, as a delay between the presentation of the stimulus and the participant's responses would inhibit the exposure effects.

Conclusions and Recommendations

The notion of unconscious mental processes has now become widely accepted within modern psychology (Kihlstrom, 1987; Greenwald, 1992), and the sheer magnitude of findings suggesting that we can be influenced in a variety of ways by stimuli that we perceive or are influenced by unknowingly is now difficult to ignore (Bargh and Chartrand, 1999; Erdelyi, 1985, 1996; Wegner and Wheatley, 1999; Westen, 1999). This research on Subliminal Perception established Subliminal Perception as a concrete phenomenon as it has an effect on human thought and behaviour. The Partial η^2 shows an Effect Size of 0.855 which indicates that there is a large difference between the two experimental groups. Thus, subliminal perception primed the responses for decision making and problem solving, and the results are significant at α

0.05 with a power of 1, with contrasting differences in the Experimental and the Control group.

Levene's Test of Equality of Error Variance, ($p=7.27>0.05$) and ($p=8.61>0.05$) means that the assumption of equal variances have not been violated.

Subliminal Perception also influenced problem solving, thus increasing time efficiency for responses as the time required for analyzing the problem, allocating resources and forming strategy was not required. This was due to the organized representation subliminally primed, which also resulted in solutions that are mainly subliminally primed in the shape recognition task in the experimental group. The p-values tell us that Subliminal Perception affects decision making ($p=.000$, $df=1$) and problem solving ($p=.000$, $df=1$) with an observed power of 1. A t-test was carried out which proved that there are no gender differences in Subliminal Perception.

However, a limitation of this study is that it has been conducted only on Indian Young adults, and thus cannot be generalized further. A larger and diverse sample can increase the generalizability of the results, thus increasing external validity. The Univariate F test could be further used to discriminate between the Dependent variables and decide whether Decision Making or Problem Solving contributes to the overall differences.

Implications

This study implies the presence of occurrences beyond the human perceptual span that could be weak to surpass our conscious awareness, but could be strong to influence our decisions and solutions to problems. Subliminal Perception is now often used for Subliminal Advertising, and the United States of America's presidential campaigns (Crowley, 2000) is another example of it. It is believed that subliminal messages are basically used in ads to affect and lead the consumers' buying decision (Benady, 2003). Many ads contain subliminal messages, although marketers and advertisers deny its usage, and many claim that it is a myth (Haberstroh, 1994). More specifically, theories associated with subliminal influence, including affective conditioning/priming, mere exposure effects, and the information-processing model have been incorporated into consumer research. The results of this study could be applied to consumer psychology, where exposure to a subliminal stimulus could lead to increase in product sales.

Time perception is dependent on the processing of information in our brain as a cumulative product of various sense organs. Our rate of perception could also possibly affect our sense of time, and definitely our constructed reality. Further research can also determine if regularly repeated exposure Subliminal Affirmations can sustain decisions for longer and form or change ill habits as proclaimed by many Subliminal Softwares. If results are positive, a new form of Behaviour Therapy Intervention might emerge if the subliminally reinforced behaviour is long lasting and relatively stable.

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