

## **Loose but Normal: A Semantic Association Study**

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*An abnormal facilitation of the spreading activation within semantic networks is thought to underlie schizophrenics' remote associations and referential ideas. In normal subjects, elevated magical ideation (MI) has also been associated with a style of thinking similar to that of schizotypal subjects. We thus wondered whether normal subjects with a higher MI score would judge "loose associations" as being more closely related than do subjects with a lower MI score. In two experiments, we investigated whether judgments of the semantic distance between stimulus words varied as a function of MI. In the first experiment, random word pairs of two word classes, animals and fruits, were presented. Subjects had to judge the semantic distance between word pairs. In the second experiment, sets of three words were presented, consisting of a pair of indirectly related, or unrelated nouns plus a third noun. Subjects had to judge the semantic distance of the third noun to the word pair. The results of both experiments showed that higher MI subjects considered unrelated words as more closely associated than did lower MI subjects. We conjecture that for normal subjects high on MI "loose associations" may not be loose after all. We also note that the tendency to link uncommon, nonobvious, percepts may not only be the basis of paranormal and paranoid ideas of reference, but also a prerequisite of creative thinking.*

**KEY WORDS:** magical ideation; schizotypy; semantic network; word associations; creativity.

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## INTRODUCTION

Since Bleuler (1911) introduced the “loosening of associations” as a crucial manifestation and as a main feature of schizophrenia, many researchers used this concept to investigate speech characteristics in psychotic patients (e.g., Levine *et al.*, 1996; Reilly *et al.*, 1975; Sommer *et al.*, 1960). Recently, this loosening of associations in patients with schizophrenia and thought disorders has been interpreted as resulting from a disinhibition of the spreading activation in semantic networks (e.g., Spitzer, 1997; Spitzer *et al.*, 1993), thus leading to the preferred selection of remote rather than close associations (Kwapil *et al.*, 1990; Manschreck *et al.*, 1988; Spitzer, 1997; Spitzer *et al.*, 1993; Weisbrod *et al.*, 1998). The question thus arises, whether milder forms of “psychotic” thinking processes would show a similarly enhanced activation in semantic networks.

One promising approach to the study of psychotic thinking involves investigating “schizotypy” in healthy subjects. Schizotypal personalities demonstrate “schizophrenialike” features, including hallucinationlike experiences and delusionlike or “paranormal” beliefs (Chapman *et al.*, 1994; Eckblad and Chapman, 1983; Kwapil *et al.*, 1999; Lenzenwenger, 1994; Thalbourne, 1994). Research on associative verbal processing has revealed considerable commonalities in the performances of schizophrenics and healthy individuals with even mild forms of schizotypal thinking (Brugger *et al.*, 1995; Duchêne, Graves, & Brugger, 1998; Merten, 1993; Miller & Chapman, 1983).

Duchêne *et al.* (1998) have shown, in a word-generation experiment, that subjects who score high on “magical ideation” (MI), one feature of a mild schizotypal thinking style (Eckblad & Chapman, 1983), produced a greater number of “unusual” words than do those who score low on MI. Pizzagalli, Lehmann, and Brugger (2001) investigated the associative basis of a specific form of MI, i.e., belief in paranormal phenomena, such as telepathy, clairvoyance, and precognition. These authors demonstrated that believers in paranormal phenomena evidenced less inhibited spreading activation than did disbelievers (as inferred from subjects’ performance on a semantic priming task with directly and indirectly associated prime–target word pairs).

In the present study, we further examined associative processing as a function of MI. In two experiments, we assessed healthy subjects’ *appreciation* of associative couplings (rather than their spontaneous production). It was predicted that subjects high on MI would judge two stimulus words as closer related in meaning than would subjects low on MI.

## EXPERIMENT 1

### Method

Thirty native English-speaking undergraduate psychology students (19 women) at the University of Victoria, without a history of neurological or psychiatric diseases, participated voluntarily after informed consent was obtained. Womens' age (mean = 24 years,  $SD = 5.2$ ) did not differ significantly from mens' age (mean = 22.36 years,  $SD = 1.57$ ) ( $t_{28} = 1.01$ ,  $p = .32$ ).

### Stimulus Material

Animal–fruit (101) pairs were used, obtained from separate students responses on a multiple-choice category fluency task (P. Brugger and R. E. Graves, unpublished data). These previous subjects (see Brugger and Graves, 1997 for detailed subject characteristics) had been asked to spontaneously name, in any order, as many animals and fruits as they could think of within 2 min. The 101 pairs used in the present study are the observed switches from the animals to the fruit category (and vice versa), e.g., elephant–banana, apple–bear.

### Procedure

The 101 word pairs were presented in a random order on sheets of paper and subjects were instructed to rate the degree of semantic distance on a 6-point scale with 1 indicating a close and 6 a distant relationship.

After the rating task, subjects completed the Magical Ideation Scale (MI) (Eckblad & Chapman, 1983). This inventory is widely used as an indicator of schizotypy and consists of 30 true/false items on hallucinationlike experiences and delusionlike beliefs. Reliability and validity data can be found in Garety and Wessely (1994).

## RESULTS

### Magical Ideation Scale

The mean MI score of women (mean = 7.37,  $SD = 3.59$ ) was not significantly different from that of the men (mean = 8.1,  $SD = 4.5$ ) ( $t_{28} = -.48$ ,  $p = .63$ ).

### **Semantic Distance**

For each subject, the mean rated semantic distance was computed across all word pairs. The correlation between individual MI scores and the semantic distance ratings was significant (Pearson  $r = 0.44$ ,  $p = .015$ ); the more magical beliefs reported, the closer the two words were rated with respect to their semantic similarity.

## **EXPERIMENT 2**

### **Method**

#### **Subjects**

A new sample of thirty native German speaking students (16 women) at the University of Zurich without a history of neurological or psychiatric diseases participated voluntarily after informed consent was obtained. Womens' age (mean = 30.25 years,  $SD = 9.31$ ) did not differ significantly from mens' age (mean = 32.93 years,  $SD = 10.46$ ) ( $t_{28} = .74$ ,  $p = .46$ ).

#### **Stimulus Material**

In a different experiment, 24 subjects spontaneously gave single word associations to 40 indirectly related and 40 unrelated word pair stimuli used in a semantic priming task (see Pizzagalli *et al.*, 2001). All words had been carefully matched according to their frequency of occurrence in written language, length, emotionality, and imagibility. For the present experiment (see Table I), word triplets were created, by appending all associations from the preceding experiment to their corresponding word pair stimuli. This resulted in a total of 807 stimuli. In 337 of the stimuli, the first two words were indirectly related to each other, in the remaining 470 triplets, they were unrelated to each other.

#### **Procedure**

The 807 stimulus triplets were printed in a pseudorandom order on paper, such that each word pair from the preceding experiment was placed on top of the complete list of all associations provided. Subjects were required to rate the semantic relatedness of the last word of the triplet with the first two words on a 6-point scale to the right of each associate, ranging from 1 (not meaningfully related) to 6 (very meaning-

**Table I.** Sample Stimuli Used in Exp. 2 (Right Column) as Derived from Other Subjects' Responses to a Previous Association Experiment (Left Column)

Association experiment <sup>a</sup>	Present experiment
Task: Provide a response word that bridges the associative gap between two stimulus words	Task: Rate the associative closeness of the response words to the corresponding stimulus word pair
Sample stimuli and response associations:	Sample items as presented on the rating sheet:
BEE–BREAD (“indirectly related”) Response association: HONEY	To the word pair: BEE and BREAD the word HONEY is semantically very closely <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> very distantly related
LADDER–BOTTLE (“unrelated”) Associations: CAT, FROG, BREAK; ACCIDENT, OPENER	To the word pair: LADDER and BOTTLE the word CAT is semantically very closely <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> very distantly related the word FROG is semantically very closely <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> very distantly related etc.

<sup>a</sup>From Gianotti *et al.*, in press.

fully related) (see Table I). For half of the word pairs, the associates from the preceding experiment were listed in decreasing response frequency (from the most frequent naming), and for the other half, in increasing response (from the least frequent naming) frequency within the original generating population. The mean ratings of all 30 subjects were calculated for each of the 337 indirectly related and 470 unrelated word triplets. After the rating task, subjects completed the Magical Ideation questionnaire.

### Analysis and Statistics

For each subject, a mean semantic rating was computed separately for the indirectly related and the unrelated pairs. These mean semantic ratings were then entered into a two-way ANOVA with group (high vs. low) as between-subject factor, and stimulus type (indirectly related vs. unrelated) as repeated measures. Unpaired *t*-tests were used post hoc.

## RESULTS

### Magical Ideation Scale

The mean MI score of the women (mean = 7.4,  $SD = 3.6$ ) was not significantly different from that of the men (mean = 7.6,  $SD = 3.9$ ) ( $t_{28} = -.14$ ). The preplanned split at the median MI scale score (7.5) produced a low (9 women, 6 men; mean score = 4.6, range 1–8) and a high (7 women and 8 men; mean score = 10.33, range 9–17) MI group. The two groups were comparable with respect to subjects' age ( $t_{28} = 0.76$ ), years of education ( $t_{28} = 0.26$ ) and gender (Chi square = 0.54).

### Associative Closeness of the Word Triplets

The two-way Anova with group (high vs. low) and stimulus type (indirectly related vs. unrelated) as factors revealed a significant main effect for group ( $F_{1,28} = 10.41$ ,  $p = .003$ ; high MI > low MI) and stimulus type ( $F_{1,28} = 176.27$ ,  $p < .0001$ ; indirectly related > unrelated) and a significant interaction ( $F_{1,28} = 4.38$ ,  $p = 0.046$ ). The post-hoc tests showed that the high MI group rated the word triplets as significantly more related in meaning than the low MI group for both the unrelated ( $t_{28} = 3.4$ ;  $p = .001$ , one-tailed) and the indirectly related word pairs ( $t_{28} = 2.35$ ,  $p = 0.023$ , one-tailed) (see Fig. 1).

## DISCUSSION

We investigated the ability of high and low MI subjects to appreciate “loose associations.” In the first experiment, we found a significant relation of individuals' MI scores and their ratings of the closeness of semantic associative distance of randomly paired words. In the second experiment, we showed that subjects with higher MI considered unrelated and indirectly related words as being more meaningfully related than did subjects with lower MI scores. Thus, in both experiments, we found a significant relationship between subjects' inclination to believe in magical forms of causation and their ratings of the associative–semantic distance between randomly paired words. These findings support the hypothesis that loose associative processing is crucial for the establishment of magical beliefs. To provide a prototypical example: an everyday coincidence, say, a near-match between the contents of a dream and an event that happened the next day, may lead to the belief in prophetic dreams if the associative links are considered “too strong” to be a consequence of mere chance. A less associative

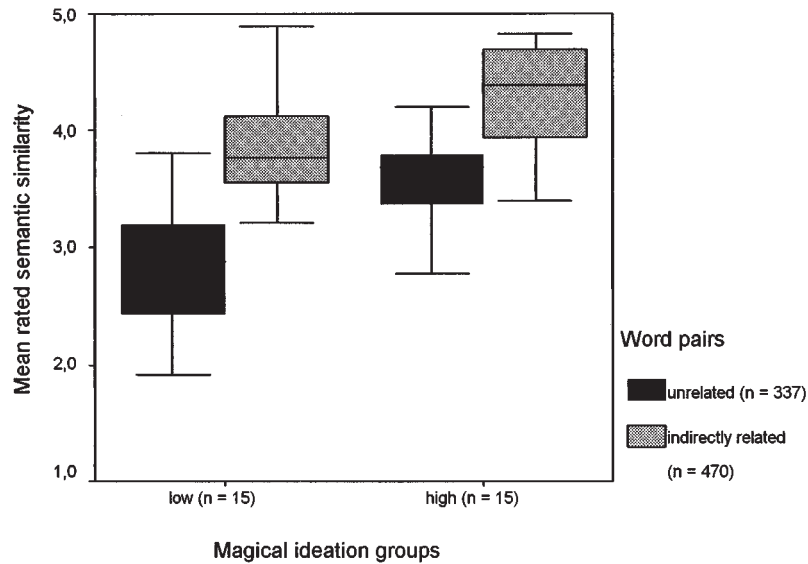


Fig. 1. Box plots of mean rated semantic similarity (1 = distant; 6 = close relationship) for the total 807 word pairs in Exp. 2.

person, who might just have noted some remote resemblance between the event and the preceding dream, will barely consider the coincidence “meaningful” and will thus be less inclined to look for an interpretation beyond chance.

Enhanced spreading activation in semantic networks has been discussed as the main core of findings of increased semantic association effects among schizophrenic individuals (Kwapil *et al.*, 1990; Spitzer *et al.*, 1993; Weisbrod *et al.*, 1998). The results of the present experiments are consistent with the view that associative meanings represented farther away in a semantic network may be coactivated easier by individuals with more magical ideations, leading to associative links that are missed by lower MI individuals (see Pizzagalli *et al.*, 2001, for relevant reaction time data). The results are also compatible with the view that high MI is associated with a shift in response criterion for accepting meaningfulness across multiple cognitive domains that can facilitate making correct associations, but can also lead to delusional-type errors (Brugger and Graves, 1997). In a computer task in which reinforcement was actually unrelated to the subject’s motor strategy, it was found that high scorers on the MI scale developed a larger number of (illusory) beliefs that their own motor behavior was closely related to the points earned during the game. We finally note that

the “loosening of associative processes” may also be responsible for a creative style of thinking. Indeed, a facilitated access to multiple word meanings has been considered the neuropsychological basis of creative reasoning and the speed of finding indirectly related concepts has since been used to quantify creativity (Mednick, 1962). Therefore, the concept of loose associations should not evoke exclusively negative connotations. While a pronounced disinhibition within semantic networks may lead to maladaptive, disordered thought, moderate forms can lead to creative insights and may even constitute an evolutionary advantage. Given these *commonalities* between pathological, paranormal, and creative styles of reasoning (Leonhard & Brugger, 1998), future research should attempt to delineate the *differences* that may or may not be part of the associative system.

## REFERENCES

- Bleuler, E. (1911/1950). *Dementia praecox or the group of schizophrenias*. New York: International Universities Press.
- Brugger, P., & Graves, R. E. (1997). Testing vs. believing hypotheses: magical ideation in the judgment of contingencies. *Cognitive Neuropsychiatry* 2, 251–272.
- Brugger, P., Regard, M., Landis, T., & Graves, R. E. (1995). The roots of meaningful coincidence. *Lancet* 345, 1306–1307.
- Chapman, L. J., Chapman, J. P., Kwapil, T. R., Eckblad, M., & Zinser, M. C. (1994). Putatively psychosis-prone subjects 10 years later. *Journal of Abnormal Psychology*, 103, 171–183.
- Duchêne, A., Graves, R., & Brugger, P. (1998). Schizotypal thinking and associative processing: a response commonality analysis of verbal fluency. *Journal of Psychiatry and Neuroscience* 23, 56–60.
- Eckblad, M., & Chapman, L. J. (1983). Magical ideation as an indicator of schizotypy. *Journal of Consulting and Clinical Psychology* 51, 215–255.
- Garety, P., & Wessely, S. (1994). The assessment of positive symptoms. In T. R. E. Barnes, & H. E. Nelson, (Eds.), *The assessment of psychoses. A practical handbook*, (pp. 21–39). London: Chapman and Hall.
- Gianotti, L. R. R., Mohr, C., Pizzagalli, D., Lehmann, D., & Brugger, P. (in press). Associative processing and paranormal belief. *Psychiatry and Clinical Neurosciences*.
- Kwapil, T. R., Chapman, L. J., & Chapman, J. P. (1999). Validity and usefulness of the Wisconsin Manual for assessing psychotic-like experiences. *Schizophrenia Bulletin* 25, 363–375.
- Kwapil, T. R., Hegley, D., Chapman, L. J., & Chapman, J. P. (1990). Facilitation of word recognition by semantic priming in schizophrenia. *Journal of Abnormal Psychology* 99, 215–221.
- Lenzenweger, M. F. (1994). The psychometric high-risk paradigm, perceptual aberrations, and schizotypy: An update. *Schizophrenia Bulletin* 20, 121–135.
- Leonhard, D., & Brugger, P. (1998). Creative, paranormal, and delusional thought: a consequence of right hemisphere semantic activation? *Neuropsychiatry, Neuropsychology, and Behavioral Neurology* 11, 177–183.
- Levine, J., Schild, K., Kimhi, R., & Schreiber, G. (1996). Word associative production in affective versus schizophrenic psychosis. *Psychopathology* 29, 7–13.



- Manschreck, T. C., Maher, B. A., Milavetz, J. J., Ames, D., Weisstein, C. C., & Schneyer, M. L. (1988). Semantic priming in thought disordered schizophrenic patients. *Schizophrenia Research 1*, 61–68.
- Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review 69*, 220–232.
- Merten, T. (1993). Word association responses and psychoticism. *Personality and Individual Differences 14*, 837–839.
- Miller, E. N., & Chapman, L. J. (1983). Continued word association in hypothetically psychosis-prone college students. *Journal of Abnormal Psychology 92*, 468–487.
- Pizzagalli, D., Lehmann, D., & Brugger, P. (2001). Lateralized direct and indirect semantic priming effects in subjects with paranormal experiences and beliefs. *Psychopathology, 34*, 75–80.
- Reilly, R., Harrow, M., Tucker, G., Quinlan, D., & Siegel A. (1975). Looseness of associations in acute schizophrenia. *British Journal of Psychiatry 127*, 240–246.
- Sommer, R., Dewar, R., Osmond, H., & Sask, W. (1960). Is there a schizophrenic language? *Archives General Psychiatry 3*, 665–673.
- Spitzer, M. A cognitive neuroscience view of schizophrenia thought disorder. *Schizophrenia Bulletin 23*, 29–50.
- Spitzer, M., Braun, U., Hermle, L., & Maier, S. (1993). Associative semantic network dysfunction in thought-disordered schizophrenic patients: Direct evidence from indirect semantic priming. *Biological Psychiatry 34*, 864–877.
- Thalbourne, M. A. (1994). Belief in the paranormal and its relationship to schizophrenia-relevant measures: A confirmatory study. *British Journal of Clinical Psychology 33*, 78–80.
- Weisbrod, M., Maier, S., Harig, S., Himmelsbach, U., & Spitzer, M. (1998). Lateralised semantic and indirect priming effects in people with schizophrenia. *British Journal of Psychiatry 172*, 142–146.