Psychoanalytic Psychology
2011, Vol. 28, No. 2, 209–228


0736-9735/11/$12.00 DOI: 10.1037/a0022392

# CONSTRUCT VALIDATION AND INTERNAL CONSISTENCY OF THE GEOMETRIC CATEGORIZATION TASK (GEOCAT) FOR MEASURING PRIMARY AND SECONDARY PROCESSES

Stijn Vanheule, PhD,
Bjorn Roelstraete, MA,
Filip Geerardyn, PhD, and
Clare Murphy, MA
*Ghent University*

Ariane Bazan, PhD
*Université Libre de Bruxelles*

Linda A. W. Brakel, MD
*University of Michigan*

The GEOCAT is a short nonverbal test for measuring two types of cognition that tally with Freud's distinction between primary and secondary unconscious processes: attributional and relational similarity judgment. Attributional similarity judgment is a mode of cognitive categorization in which stimuli are classified based on perceptual resemblances between attributes and features, just like in primary processing. Relational similarity judgment is a mode of cognitive categorization that builds on higher order relationships between stimuli, just like in secondary processing. The GEOCAT can be used in diverse research contexts, and test administration takes 2 minutes. The present study investigates the construct validity and internal consistency of this instrument in a sample of Belgian university students. A confirmatory factor analysis for binary items indicates that a dimension reflecting relational or attributional categorization processes lies behind the GEOCAT items, that this model has a good fit to the

Stijn Vanheule, PhD, Department of Psychoanalysis and Clinical Consulting, Ghent University, Ghent, Belgium; Bjorn Roelstraete, MA, Department of Data-Analysis, Ghent University, Ghent, Belgium; Filip Geerardyn, PhD, Department of Psychoanalysis and Clinical Consulting, Ghent University, Ghent, Belgium; Clare Murphy, MA, Department of Psychoanalysis and Clinical Consulting, Ghent University, Ghent, Belgium; Ariane Bazan, PhD, Department of Psychology and Educational Sciences, Université Libre de Bruxelles, Brussels, Belgium; and Linda A. W. Brakel, MD, Department of Psychiatry, University of Michigan.

Correspondence concerning this article should be addressed to Stijn Vanheule, PhD, Ghent University, Department of Psychoanalysis and Clinical Consulting, H. Dunantlaan 2, B-9000 Ghent, Belgium. E-mail: stijn.vanheule@ugent.be

data, and that all items are equally good indicators of these processes. We also compared the GEOCAT to an alternative measure that builds on a continuous scale for similarity judgment. Correlations between corresponding subscales were moderate and three GEOCAT items proved to be problematic. Internal consistency proved to be good. Suggestions for future research on similarity judgment and primary and secondary processes are discussed.

*Keywords:* categorization, unconscious, assessment, decision making

In his metapsychological writings, Freud distinguished between two fundamental modes of mental functioning: the primary and secondary process. The primary process denotes mechanisms of association that are characteristic of unconscious mental life. More specifically, it refers to mechanisms of condensation and displacement (Freud, 1900/1953). For Freud, condensation means that libidinal excitation that is linked to one idea is connected or condensed with another, and, as a result, certain ideas are formed that are endowed with great intensity; displacement implies that excitation can transfer from one idea to the other, even though the ideas may stand in loose mutual relation to one another (Freud, 1900/1953, pp. 595–596).

Condensation and displacement typically build on what Freud calls the "perceptual identity" of ideas (1900/1953, p. 602), including visual and phonetic characteristics and similarities. Typical of the primary process, both mechanisms are also directly oriented to the satisfaction of drive impulses. The secondary process, on the other hand, refers to rational thinking. It builds on the "thought identity" or the actual content of ideas (Freud, 1900/1953, p. 602), and functions to make logically plausible connections between them, while ignoring the intensity of the excitation related to them. The secondary process is guided by what Freud (1911/1958) calls the reality principle; it governs primary process tendencies that follow the pleasure principle.

For Freud (1900/1953, 1911/1958), the relation between the primary and secondary process was understood to be concurrent. In childhood, the secondary process is less developed and therefore the primary process dominates. This is evident in the child's direct and unrepressed search for satisfaction. Ontogenetic development, however, reverses this relation: In adult life, the secondary process dominates, but this cognitive shift does not extinguish the primary process or the interaction between the primary and secondary processes. In this sense, when inhibitory control temporarily diminishes, manifestations of the primary process appear in privileged aspects of adult mental life, such as symptoms, dreams, parapraxes, and so on. These are understood in psychoanalysis as productions influenced by unconscious mentation. A further characteristic in which primary process functioning is expressed is creativity.

## Later Discussion of Freud's Concept of the Primary and Secondary Process

Discussion of the primary and secondary process did not end with Freud. For example, Rapaport (1950) argued that the primary and secondary processes should be thought of as two modes of memory organization. For him, the primary process should be seen as a drive organization of memory. This means that primary process ideation is organized in relation to instinctual tensions that are only weakly connected to memories. This gives rise to condensation, displacement and loose associations between ideas. Conversely, secondary process thinking is organized conceptually, independent of instinctual life, and is

bound rather than free. This process facilitates the establishment of permanence in representation. Rapaport and Gill (Rapaport & Gill, 1959; Gill, 1988) also discussed the developmental transition from the dominance of primary process functioning to the dominance of secondary process thinking in terms of adaptation to reality. This perspective was brought forward with Fast (1983), who argued in terms of Piaget's developmental psychological theory that primary process functioning is particularly focused on concrete events, whereas the secondary process is marked by categorical and logical thinking. Freud's suggestion that the primary process is intimately related to creativity was further explored by Suler (1980), who argued that while the primary process and creativity are indeed related, creative skill is particularly connected to the level of integrative control that the secondary process initiates over primary process manifestations.

Freud's concepts of the primary and secondary processes are nevertheless controversial and have been reinterpreted by several authors. For example, Lacan (1960/2006) argued for a materialistic interpretation of these processes in terms of specific linguistic mechanisms that can be detected in free associative speech. This is reflected in his comparison of the linguistic mechanisms metaphor and metonymy with Freud's notion of condensation and displacement. Indeed, recently, this linguistic interpretation of primary and secondary processes was further explored within a neurophysiological framework (Bazan, 2007a). Other authors have argued that primary and secondary processes should be understood as two modes of thought, regardless of the specific content: Secondary process thinking is the rational and logical connection between words, while primary process thinking is associative, building on similarity between word sounds (Shevrin & Fisher, 1967).

The explanation of primary and secondary processes in terms of drive cathexis was criticized by Noy (1969) and reframed in terms of information processing. From this perspective, the primary process is seen as a self-centered system that aims at integrating new experiences in the self and at maintaining continuity, while the secondary process concerns adaptation to reality.

A reformulation of the theory on primary process thinking was recently taken up in cognitive science. Holt (2009) proposed that manifestations of primary process thinking will be produced when the active cognitive control and monitoring mechanisms that make our thinking adaptive (e.g., logical consistency or morality) are impaired. Such impairment can be temporary, for example, in sleep, or more fundamental, such as in psychopathology.

## Criticism of Theories on the Primary and Secondary Process

More fundamental criticisms of psychoanalytic theories about the primary and secondary process have been formulated as well. In Epstein's view, "a critical weakness in Freud's conceptualization" (1994, p. 709) is that he did not sufficiently explain how such a maladaptive system could evolve. Epstein (1994) states that from an evolutionary perspective, to postulate the primary process makes little sense. Brakel and Shevrin (2003; Brakel, 2009) disagree with this criticism and argue that both primary and secondary process thinking play a different but equally important role in developmental adaptation. Primary process mentation does not follow the constraints of rationality. In this system, information is processed in a highly personal way, via associative connections often predicated on the mechanisms of condensation and displacement, outside the realm of ordinary logic. Secondary process thinking does not supplant the primary process; each

has added value, and it is hypothesized that both processes contribute to evolutionary success (Brakel & Shevrin, 2003; Brakel, 2009). Another major evolutionary value of the primary process resides in the fact that it enables stability of perception by searching for an identity of the percept, whatever the context (see Bazan, 2007b). An object can thereby be identified as such, even if it is only perceivable through one of its attributes or aspects.

Epstein also (1994) argued that the primary process is not the sole organizing principle of the unconscious. He says that it is accompanied by other automatic systems of subconscious cognition that are more adaptive, but he fails to explain the interaction between these systems. Other authors, such as Peterfreund and Schwartz (1971), argue that the distinction between primary and secondary process thinking is irrelevant and suggest dropping these concepts, as they are vague, inexact, and fail to facilitate conceptualization of complex observable phenomena. This viewpoint finds support with other critics (for a further review of criticisms, see Holt [2009]).

In our view, the concept of primary and secondary process mentation is not only clinically useful but also important for aligning psychoanalytic concepts with those of cognitive psychology and cognitive neuroscience (see Stanovich & West, 2001; Carhart-Harris & Friston, 2010).

## Measuring Primary and Secondary Process Mentation

Throughout the years, several instruments have been developed to measure primary and secondary process thinking. These instruments focus on specific content and/or on formal characteristics of text materials or responses to tests. An example of a content-oriented system can be found in Martindale's (1975, 1990) Regressive Imagery Dictionary. This is a coding scheme that can be applied in computerized lexical analyses of a variety of text materials. The dictionary consists of 3,200 words that are a priori assigned to 29 categories of primary process cognition and 7 categories of secondary process cognition. The system is designed to assess the extent to which primary and secondary process language is present in a text.

An example of a method assessing both content and formal characteristics of primary processes mentation is Holt's Primary Process System (PRIPRO-system; see Holt [2007, 2009]). The PRIPRO-system is designed for scoring Rorschach protocols and story-like materials such as TAT stories and free associations. In terms of content, the PRIPRO-system traces the expression of aggressive and libidinal themes. In its focus on formal characteristics of primary processes mentation, it examines whether manifestations of condensation, displacement, symbolization, contradiction, distortion, and overtness can be discerned in people's thinking.

The present study concentrates on the geometric categorization task (GEOCAT), which is an example of a formal measure of primary and secondary process thinking.

## GEOCAT

The GEOCAT was developed by Brakel and colleagues (Brakel, Kleinsorge, Snodgrass, & Shevrin, 2000; Brakel, 2004; Brakel, Shevrin, & Villa, 2002) to measure primary and secondary processes outside the setting of psychoanalytic practice. The theoretical basis of the instrument is that primary and secondary processes are two distinct modes of mental organization that permeate everyday cognitive functioning: relational and attributional cognition. Attributional cognition is a mode of cognitive categorization in which stimuli

are classified on the basis of attributes, that is, perceptual resemblance and impressions. It builds on what Freud called the identity of perception and bears witness of primary processing. Relational cognition is a mode of cognitive categorization that builds on logical relationships between stimuli and takes the total configuration of the components into account, indicative of secondary processing. Both mental processes are seen as prior to specific thought contents and contribute to normal functioning. Primary process mentation especially comes to the fore early in development, in implicit rather than explicit tasks and in situations of conflict, psychopathology, and sleep.

Two hypothetical examples can illustrate the difference between attributional and relational cognition. First, Ask a 4-year-old boy and a 10-year-old boy what is most characteristic of a girl in comparison to a boy. There is quite a chance that the 4-year-old will list characteristics such as "girls have long hair" or "girls wear dresses," while a 10-year-old might list characteristics such as "girls become women" or "girls can have a baby when they grow up." The first two answers concern salient exterior characteristics and reflect attributional thinking; the second two answers bear witness of insight into typical developmental trajectories and reflect relational thinking. Second, ask people why they hate rats. Some might say "rats have a creepy tail" or "rats live in the dirt." Others might say "rats spread diseases" or "rats eat their own offspring." Regardless of whether the second two statements are correct, they bear witness of a thought process in which an implicit idea on the spreading of diseases and a normative idea on mothering come to the fore. This is typical of relational judgments. The first two answers are mere observations and impressions that build on external attributes, illustrative of attributional cognition.[1]

The GEOCAT is derived from cognitive psychology and is designed to assess attributional and relational cognition via a nonverbal similarity judgment using geometric figures. Attributional similarity judgment builds on concrete and perceptual characteristics of reference stimuli and reflects the resemblance of (some of) these concrete and perceptual characteristics. As attributional similarity judgment is based on the perceptual identity of stimuli, it is proposed to reflect primary process mentation. Relational similarity judgment builds on abstract rule-bound principles and logical thinking (Brakel, 2004). From a Freudian point of view, this type of cognitive process is based on the thought identity of given cues and reflects secondary-process mentation.

The instrument comprises sets of geometric figures that are presented to participants (see, for example, Figure 1). Dependent on the study design, the presentation of each geometric cue is subliminal or supraliminal. Participants are asked to indicate which of the lower target alternative figures is most similar to the upper master figure. With only two alternative figures to choose from (i.e., a figure that is relationally connected to the reference figure and one that is attributionally related to the reference figure), the participant must make either a relational or an attributional similarity judgment. In making this choice, participants remain blind to the type of similarity their choice reflects.

The GEOCAT consists of two lists of categorization items (Figure 2, List 1 and List 2), with two task versions per list (Figure 2, Version A and Version B). The two versions were developed with the aim of controlling for lateralization bias, that is, the possible tendency to prefer things that are either on the left side or on the right side. Therefore, the instrument consists of four sets of items, and each set consists of six items. In each version of a list (i.e., List 1, versions A and B; List 2, versions A and B), the master figures are

[1] See also Brakel (2004, pp. 1132–1133, 1137) for a clinical example and Brakel, Shevrin, and Villa (2002, pp. 498–499) for a detailed developmental example.

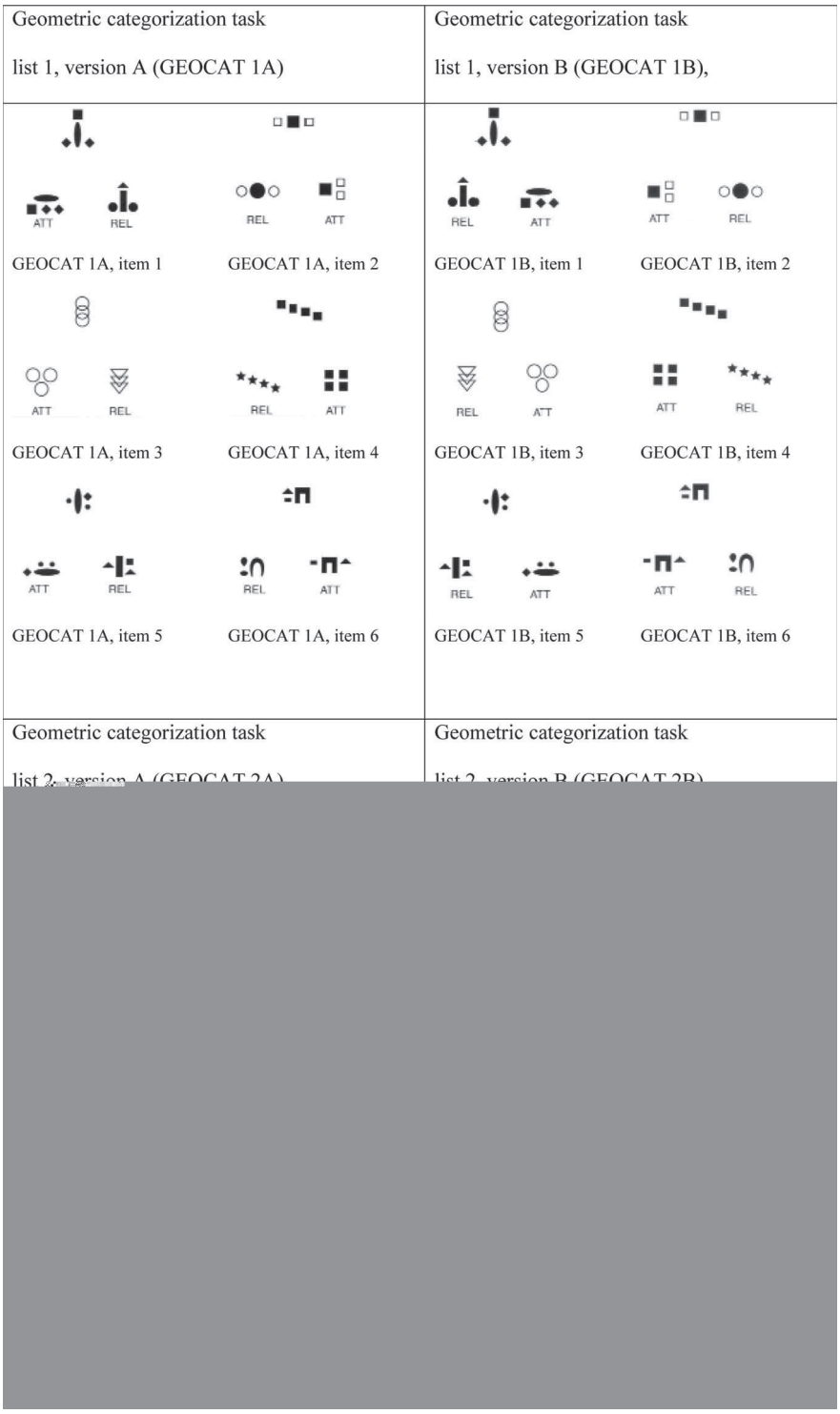


*Figure 2.* Items geometric categorization task for similarity judgment (GEOCAT): two sets of items with two task versions per set and six items per version.

These findings suggest that the GEOCAT may be a useful measure of an individual's tendency toward attributional or relational similarity judgment. However, validation studies of this instrument are lacking.

## A Test of the Construct Validity and the Internal Consistency of the GEOCAT

In this paper, we investigate the construct validity and internal consistency of the GEOCAT, and we check whether previously observed correlations of attributional and relational cognition with age and gender can be replicated.

First, we examine correlations with age and gender. As indicated in this discussion, previous studies of GEOCAT with children found that relational similarity judgment becomes more dominant with increasing age (Brakel, Shevrin, & Villa, 2002). In this study, we extend this idea by examining it in a large group of university students. Another finding from previous studies is that attributional and relational cognition are not related to gender differences (Brakel et al., 2000; Brakel, 2004). We check if we can replicate this finding.

In testing these ideas, we distinguish three groups based on the data: a group with more relational choices than attributional choices; a group with an equal number of relational choices as attributional choices; and a group with more attributional choices than relational choices. We hypothesize that these groups do not differ in terms of gender distribution (Hypothesis 1); that the group with more relational choices is significantly older than the other groups (Hypothesis 2); and that the group with more attributional choices is significantly younger (Hypothesis 3).

As another instrument (the GEOSCALAR) is administered in combination with the GEOCAT, we examine whether an order effect is present. In other words, we examine whether participants who filled out the GEOCAT before the GEOSCALAR, and vice versa, had significantly different GEOCAT and GEOSCALAR scores. We hypothesize that this is not the case (Hypothesis 4).

In terms of construct validation, two main assumptions that underlie the GEOCAT are examined: (a) that a dimension reflecting relational and attributional categorization processes lies behind the items, and (b) that the items of both lists are equally good indicators of these processes. We test the hypotheses that both assumptions hold true (Hypothesis 5 and Hypothesis 6). These hypotheses are tested by means of a confirmatory factor analysis for binary items. This method allows us the check whether our theoretical assumption of two underlying dimensions holds true and is suited for the binary response format.

A further step in validating the instrument is made by examining correlations between the GEOCAT and the GEOSCALAR (Brakel, unpublished). This newly constructed instrument was used instead of more established instruments, such as Holt's (2007, 2009) Primary Process System or Martindale's (1975, 1990) Regressive Imagery Dictionary, because these measures use a different operationalization of the concepts of primary and secondary process. Moreover, Holt's and Martindale's measures are based on content analyses of linguistic material, which could produce correlations that are too small to test the validity of the GEOCAT. In this stage of validity testing, we chose to use a concurrent measure of the GEOCAT. The GEOSCALAR was developed as an alternative measure of attributional and relational similarity judgment, in which the strength of attributional similarity and of relational similarity can be measured independently. The GEOSCALAR

uses the same geometric figures as the GEOCAT, but respondents must rate, on a continuous scale, how similar the figures are to the master figure.

We test the hypothesis that the relational scores on GEOCAT and GEOSCALAR are positively correlated; that attributional scores on both instruments are positively correlated; that relational GEOCAT scores are negatively correlated with attributional GEOSCALAR scores; and that attributional GEOCAT scores are negatively correlated with relational GEOSCALAR scores (Hypothesis 7). In terms of the GEOCAT items, we test the assumption that participants who make more attributional similarity judgments on a GEOCAT item have corresponding GEOSCALAR attributional scores, lower GEOSCALAR relational scores, and vice versa (Hypothesis 8).

Finally, we investigate internal consistency to asses the instrument's reliability. We hypothesize that for both lists of GEOCAT items, the values for Cronbach's alpha (which indicates how well a set of items measures a single unidimensional latent construct) are adequate (Hypothesis 9).

## Method

### *Participants*

Participants were 399 university students (86.8% women) who were attending an introductory psychology course. The mean age was 19.35 years ($SD = 2.31$). Through their curriculum, these students were not yet familiarized with Freudian theory on primary and secondary processes or acquainted with theory on attributional and relational similarity judgment. The project was approved by Ghent University's Institutional Review Board.

### *Instruments and Procedure*

Students were asked to participate in a study on human decision making and gave written informed consent. Participants then anonymously provided biographical information and filled out the GEOCAT and the GEOSCALAR.[2]

Each participant filled out one of the four possible GEOCAT sets (see Figure 2). For each of the six items, they were asked to indicate which of the two alternative images (depicted beneath the master figure) is most similar to the master figure. Scores for attributional and relational similarity are calculated by counting the number of attributional and relational choices a participant makes (ranging from 0 to 6).

In administering the GEOCAT, it was ensured that an equal number of participants filled out each version of the item-sets. The particular version that each participant filled out was randomly determined. Through this method, 24% filled out set 1A; 25%, set 1B; 26%, set 2A; and 25%, set 2B. These groups did not differ significantly with respect to gender ($\chi^2 = 3.84$, $df = 3$, $p = .28$) or age, $F(3, 384) = 1.93$, $p = .12$.

Since no instruments similar to the GEOCAT are currently used in published research on primary and secondary processes or attributional and relational similarity judgment, an alternative measure that uses a continuous judgment scale was developed. This instrument (GEOSCALAR; Brakel, unpublished) uses the same geometric figures as the GEOCAT, but instead of asking participants for categorical similarity judgments, it asks participants to indicate, on a continuous scale, how similar two figures are (see Figure 3). The

[2] Copies of both instruments can be obtained via Linda A. W. Brakel at this address: 525 Third Street, Ann Arbor, MI 48103, USA.

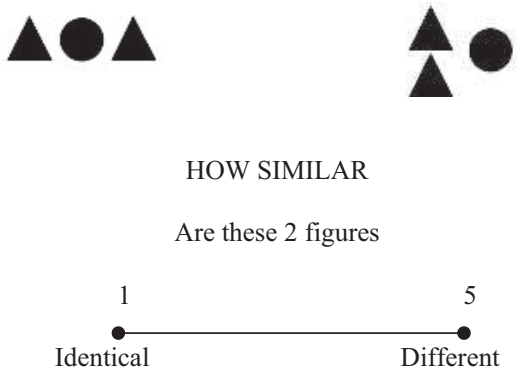


*Figure 3.* Sample item geometric scaling task for similarity judgment (GEOSCALAR).

GEOSCALAR includes 24 items. It was developed by taking the 12 master figures from the GEOCAT (see Figure 2) and putting these in paired opposition with the relational and the attributional alternatives of the corresponding GEOCAT item. Twelve items assess attributional similarity judgment, and 12 items assess relational similarity judgment. Scores for the strength of similarity judgment on a GEOSCALAR item are obtained by measuring the distance in centimeters from Point 1, where participants marked the line (range: 0–5 cm). Total GEOSCALAR scores for attributional and relational similarity judgment are obtained by calculating the mean scale score for the 12 items that assess attributional similarity and for the 12 items that assess relational similarity. This score reflects how different the items are judged to be. To obtain the score for how similar the items are judged to be, the mean scale score is subsequently subtracted from 5. Unlike the forced-choice answer format used in the GEOCAT—where higher scores for attributional similarity imply lower scores for relational similarity and vice versa—the GEOSCALAR uses separate, independent continuous scales for each of the relational and attributional similarity judgments.

The order in which the 24 GEOSCALAR items were presented to participants was fully randomized and therefore different for each participant. Fifty percent of the participants first filled out the GEOCAT, and then the GEOSCALAR. For the other half of the sample, we reversed this order.

## *Data Analysis*

First, the GEOCAT data of sets 1B and 2B were recoded, such that these scores have the same meaning as scores on the corresponding items of versions 1A and 2A, respectively. Further analyses no longer take into account differences between versions A and B, and solely concentrate on GEOCAT lists 1 and 2 and their 12 constituent items.

Hypothesis 1, which states that the three GEOCAT groups (i.e., a group with more relational choices than attributional choices; a group with an equal number of relational choices as attributional choices; and a group with more attributional choices than relational choices) do not differ in terms of gender distribution, is examined with a $\chi^2$ difference test.

Hypothesis 2, which states that the group with more relational choices is significantly older than the other groups, and Hypothesis 3, which states that the group with more

attributional choices is significantly younger, are tested with *t* tests and by calculating the effect size of this difference (*B*-statistic with 95% confidence intervals).

Hypothesis 4, which states that participants who filled out the GEOCAT before the GEOSCALAR, and vice versa, do not have significantly different GEOCAT and GEOSCALAR scores, is also tested with *t* tests and by calculating the effect size of the difference.

Hypothesis 5, which states that a dimension reflecting relational and attributional categorization processes lies behind the GEOCAT items, and Hypothesis 6, which states that the items of both lists are equally good indicators of these processes, are tested with a Confirmatory Factor Analysis (CFA). The binary GEOCAT items were our observed variables, which makes this CFA equivalent to an Item Response Theory (IRT) model[3] (Van der Linden & Hambleton, 1996). We assumed one latent factor in the model, that is, one factor which reflects attributional versus relational categorization. In line with IRT modeling, we fixed the variance of this latent factor in order to free the estimates of the GEOCAT items. The two lists of six GEOCAT items were analyzed separately in two CFAs. The model fit was evaluated by means of the $\chi^2$ significance test, the Confirmatory Fit Index (CFI), and the Root Mean Square Error of Approximation (RSMEA; Hoyle & Panter, 1995). The cutoff criteria used were based on Browne and Cudeck (1993) and Hu and Bentler (1998, 1999). The $\chi^2$ significance test determines whether variances and covariances between empirically measured variables differ significantly from the pattern of variances and covariances that are theoretically expected. The CFI is an incremental fit index that compares a proposed model to the null model; values greater than .95 indicate good fit. The RMSEA is a badness-of-fit measure of the error approximation in the population that indicates the discrepancy per degree of freedom; values less than .06 indicate good fit and values less than .08 indicate moderate fit.

We used point biserial correlations to investigate Hypothesis 7, which assumed that the relational scores on the GEOCAT and the GEOSCALAR are positively correlated; that attributional scores on both instruments are positively correlated; that relational GEOCAT scores are negatively correlated with attributional GEOSCALAR scores; and that attributional GEOCAT scores are negatively correlated with relational GEOSCALAR scores.

In terms of the GEOCAT items, we hypothesized that participants who make more attributional similarity judgments on a GEOCAT item have corresponding GEOSCALAR attributional scores, lower GEOSCALAR relational scores, and vice versa (Hypothesis 8). To test this hypothesis, 24 analyses of variance (ANOVA) were carried out. We performed 12 ANOVAs in which the attributional GEOSCALAR score was our dependent variable and the 12 GEOCAT items were our independent variables; and 12 ANOVAs in which the relational GEOSCALAR score was our dependent variable and the 12

---

[3] Item Response Theory (IRT) is a theory that describes the application of mathematical models and statistical procedures to data from questionnaires and tests as a basis for measuring latent traits, abilities, or attitudes. IRT models are often referred to as latent trait models. The term *latent* is used

GEOCAT items were our independent variables. We performed separate ANOVAs for each GEOCAT item because the items were strongly correlated with each other. Regressing the GEOSCALAR on all the items simultaneously would create multicollinearity between predictors, which would lead to erroneous estimation of the individual predictors. To control for the inflated probability of Type I error that is related to performing multiple concurrent tests, the significance level was lowered to .002 (Bonferroni adjustment, .05/24 = .002).

Finally, to test the assumption of good internal consistency (Hypothesis 9), Cronbach's alpha was calculated.

## Results

### *Descriptive Statistics and Correlations Between the GEOCAT and Biographical Variables*

Figure 4 gives an overview of participants' attributional and relational similarity preferences. Of all participants, 63% made more relational choices than attributional choices, 10% made an equal number of relational choices as attributional choices (we will call this the neutral group), and 27% made more attributional choices than relational choices.

In line with Hypothesis 1, which assumed that these groups would not differ in terms of gender distribution, chi-square tests revealed that the groups are unrelated to gender ($\chi^2 = .94$, $df = 2$, $p = .63$).

Following this, we examined whether the three groups differed with respect to age. Contrary to what we expected in Hypothesis 2, that is, that the group with more relational choices would be significantly older than the other groups, the results indicate that the group that made more relational choices (mean age = 19.35 years, $SD = 2.24$) did not differ significantly from the neutral group (mean age = 20.50 years, $SD = 4.18$; $B = -1.15$ [95% CI = −2.51, 0.21], $t = -1.70$, $df = 42.83$, $p = .10$). However, in line with Hypothesis 2, we found that this group was significantly older than the group with more attributional choices (mean age = 18.94 years, $SD = 1.04$; $B = 0.41$ [95% CI = 0.06, 0.76], $t = 2.30$, $df = 337.55$, $p = .02$).

In line with Hypothesis 3, which stated that the group with more attributional choices is significantly younger, we observed that this group was significantly younger than the group which made more relational choices ($B = 0.41$ [95% CI = 0.06, 0.76], $t = 2.30$,

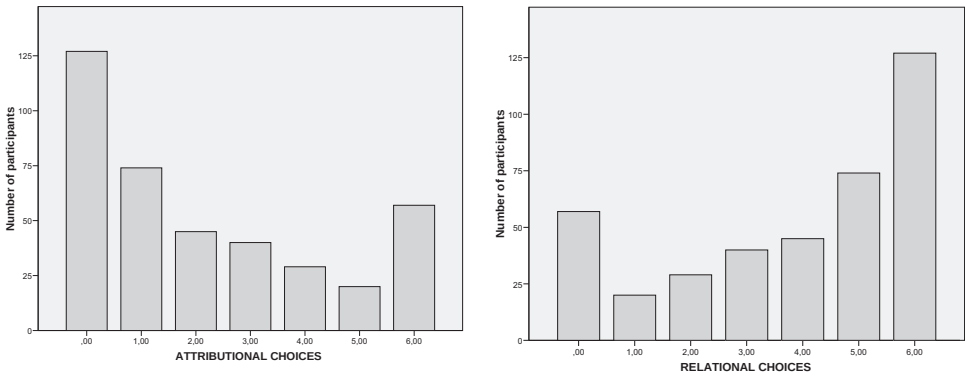


*Figure 4.* Number of participants and their attributional and relational GEOCAT choices.

$df = 337.55$, $p = .02$), and than the neutral group ($B = 1.56$ [95% CI = 0.21, 2.91], $t = 2.33$, $df = 40.91$, $p = .03$). We also observed that there was no relation between the three groups and the particular set of GEOCAT items they filled out ($\chi^2 = 4.18$, $df = 6$, $p = .65$).

The mean GEOSCALAR attributional similarity score was 2.17 ($SD = 0.86$), and the mean GEOSCALAR relational similarity score was 2.44 ($SD = 0.93$). The relational similarity score is significantly higher than the attributional similarity score ($B = -0.27$ [95% CI = −0.40, −0.14], $t = -4.02$, $df = 371$, $p < .01$). GEOSCALAR attributional scores correlate −.01 ($p = .80$) with GEOSCALAR relational scores. In terms of biographical variables, a significant but weak positive correlation between relational GEOSCALAR scores and age was observed ($r = .13$, $p = .01$), but age was not significantly related to attributional GEOSCALAR scores ($r = .01$, $p = .84$). Male and female participants did not differ significantly in their attributional ($B = -0.08$ [95% CI = −0.33, 0.18], $t = -0.60$, $df = 379$, $p = .55$) and relational ($B = -0.11$ [95% CI = −0.39, 0.16], $t = -0.80$, $df = 380$, $p = .42$) GEOSCALAR scores.

In a next step, we examined Hypothesis 4, which stated that participants who filled out the GEOCAT before the GEOSCALAR, and vice versa, would not have significantly different GEOCAT and GEOSCALAR scores. No order effect was observed for the GEOCAT (relational scores for the GEOCAT were $B = 0.20$ [95% CI = −0.23, 0.63], $t = .90$, $df = 390$, $p = .37$; attributional scores for the GEOCAT were $B = -0.20$ [95% CI = −0.63, 0.23], $t = .90$, $df = 390$, $p = .37$), but contrary to what we hypothesized, an order effect was present for the GEOSCALAR: Participants who first filled out the GEOCAT had higher GEOSCALAR relational similarity scores than participants who first completed the GEOSCALAR ($B = -0.65$ [95% CI = −0.82, −0.48], $t = -7.36$, $df = 383$, $p < .01$). For GEOSCALAR attributional similarity scores, no order effect was observed ($B = -0.09$ [95% CI = −0.24, 0.10], $t = -0.87$, $df = 381$, $p = .39$).

## *Construct Validation*

In terms of construct validation, we first tested Hypothesis 5, which states that a dimension reflecting relational and attributional categorization lies behind the items. The CFAs indicate that the assumed model with one latent factor reflecting attributional and relational similarity fits particularly well to GEOCAT List 1 response pattern ($\chi^2 = 18.78$, $df = 17$, $p = .34$; CFI = .998; RMSEA = .024). The fit with the GEOCAT List 2 response pattern is acceptable ($\chi^2 = 30.04$, $df = 17$, $p = .03$; CFI = .983; RMSEA = .065).

Subsequently, we checked Hypothesis 6, which states that each of the GEOCAT items is a good indicator of relational and attributional categorization processes. Table 1 lists estimated factor loadings and the amount of explained variance for each GEOCAT item of GEOCAT lists 1 and 2. The results show that all items have substantial factor loadings but that the amount of variance explained in item 6 of both lists is substantially lower than in the other items.

In a next step, we examined relations between the GEOCAT and the GEOSCALAR. In line with Hypothesis 7, we observed that the GEOCAT attributional score correlates .36 ($p < .01$) with the GEOSCALAR attributional score and −.34 ($p < .01$) with the GEOSCALAR relational score. Given the inverse relationship between attributional and relational scores, the GEOCAT relational score correlates .34 ($p < .01$) with the GEOSCALAR relational score and −.36 ($p < .01$) with the GEOSCALAR attributional score.

Table 1
*CFA Factor Loadings and Amount of Explained Variance for GEOCAT Items in Relation to a Latent Similarity Variable*

| | GEOCAT List 1 | | GEOCT List 2 | |
|---|---|---|---|---|
| GEOCAT item | Factor loading | $R^2$ | Factor loading | $R^2$ |
| Item 1 | 0.907 | 0.870 | 0.907 | 0.822 |
| Item 2 | 0.962 | 0.926 | 0.891 | 0.794 |
| Item 3 | 0.910 | 0.828 | 0.893 | 0.797 |
| Item 4 | 0.886 | 0.785 | 0.851 | 0.724 |
| Item 5 | 0.864 | 0.747 | 0.911 | 0.831 |
| Item 6 | 0.758 | 0.575 | 0.771 | 0.595 |

*Note.* $R^2$ = amount of explained variance.

The ANOVAs performed to test Hypothesis 8—stating that participants who chose the attributional answer on a GEOCAT item also have higher GEOSCALAR attributional scores, lower GEOSCALAR relational scores, and vice versa—indicate that most GEOCAT items explain significant amounts of variance in the GEOSCALAR subscale scores (see Table 2). Items for which this assumption does not hold true are GEOCAT

Table 2
*Effect Size and Significance of ANOVA Parameter Estimates With GEOCAT Items as Independent Variables and GEOSCALAR Attributional and Relational Similarity Scores as Dependent Variable*

| GEOCAT list number | GEOCAT item number | GEOSCAL attributional similarity | GEOSCAL relational similarity |
|---|---|---|---|
| 1 | 1 | $B = 2.09$ [CI 95% = 1.33, 2.86], $t = 5.40$, $df = 180$, $p < .001$ | $B = -2.29$ [CI 95% = −3.12, −1.45], $t = -5.39$, $df = 184$, $p < .001$ |
| | 2 | $B = 1.00$ [CI 95% = 0.25, 1.75], $t = 2.62$, $df = 180$, $p = .009$ | $B = -2.43$ [CI 95% = −3.19, −1.67], $t = -6.30$, $df = 184$, $p < .001$ |
| | 3 | $B = 1.67$ [CI 95% = 0.86, 2.47], $t = 4.09$, $df = 180$, $p < .001$ | $B = -1.68$ [CI 95% = −2.57, −0.80], $t = -3.75$, $df = 184$, $p < .001$ |
| | 4 | $B = 1.93$ [CI 95% = 1.15, 2.70], $t = 4.92$, $df = 180$, $p < .001$ | $B = -2.04$ [CI 95% = −2.89, −1.20], $t = -4.76$, $df = 184$, $p < .001$ |
| | 5 | $B = 1.30$ [CI 95% = 0.59, 2.02], $t = 3.61$, $df = 180$, $p < .001$ | $B = -1.33$ [CI 95% = −2.13, −0.53], $t = -3.29$, $df = 184$, $p = .001$ |
| | 6 | $B = 1.38$ [CI 95% = 0.68, 2.08], $t = 3.86$, $df = 180$, $p < .001$ | $B = -1.46$ [CI 95% = −2.24, −0.67], $t = -3.65$, $df = 184$, $p < .001$ |
| 2 | 1 | $B = 1.41$ [CI 95% = 0.62, 2.21], $t = 3.50$, $df = 186$, $p = .001$ | $B = -1.31$ [CI 95% = −2.17, −0.46], $t = -3.03$, $df = 184$, $p = .001$ |
| | 2 | $B = 2.06$ [CI 95% = 1.33, 2.79], $t = 5.57$, $df = 185$, $p < .001$ | $B = -1.40$ [CI 95% = −2.22, −0.59], $t = -3.41$, $df = 184$, $p = .001$ |
| | 3 | $B = 2.13$ [CI 95% = 1.32, 2.94], $t = 5.18$, $df = 186$, $p < .001$ | $B = -1.91$ [CI 95% = −2.79, −1.04], $t = -4.30$, $df = 184$, $p < .001$ |
| | 4 | $B = 2.07$ [CI 95% = 1.28, 2.86], $t = 5.14$, $df = 186$, $p < .001$ | $B = -1.48$ [CI 95% = −2.36, −0.61], $t = -3.35$, $df = 184$, $p < .001$ |
| | 5 | $B = 1.48$ [CI 95% = 0.67, 2.30], $t = 3.60$, $df = 186$, $p < .001$ | $B = -1.05$ [CI 95% = −1.92, −0.17], $t = -2.37$, $df = 184$, $p = .019$ |
| | 6 | $B = .55$ [CI 95% = −0.26, 1.37], $t = 1.35$, $df = 186$, $p = .180$ | $B = -1.09$ [CI 95% = −1.94, −0.23], $t = -2.50$, $df = 184$, $p = .013$ |

Item 2 from List 1 and Item 6 from List 2, which fail to explain a significant amount of variance in the GEOSCALAR attributional similarity score, and GEOCAT items 5 and 6 from List 2, which fail to explain a significant amount of variance in the GEOSCALAR relational similarity score. In line with Hypothesis 8, the direction of the observed effects indicates that participants who chose the attributional answer on a GEOCAT item also had higher GEOSCALAR attributional scores and lower GEOSCALAR relational scores and vice versa.

### *Internal Consistency*

In line with Hypothesis 9, tests of internal consistency indicate that the Cronbach's alpha of both lists of items is adequate: Cronbach's alpha GEOCAT List 1 = .88; Cronbach's alpha GEOCAT List 2 = .96. This indicates that the items from both lists measure a single, unidimensional latent construct.

## Discussion

In this paper, we report on the construct validation and internal consistency of the GEOCAT. This instrument is a short, nonverbal categorization task that maps attributional and relational similarity judgments. Attributional similarity judgment is a mode of cognitive categorization in which stimuli are classified based on perceptual resemblance and impression. Relational similarity judgment is a mode of cognitive categorization that builds on higher order relationships between stimuli. The GEOCAT comprises sets of geometric figures. Each time, participants are asked which of two alternative figures are most similar to a reference figure. One of the two alternative figures is relationally connected to the reference figure and the other is attributionally related to it. The theoretical basis of the task is Freud's distinction between primary process thinking (categorization by attribute) and secondary process thinking (categorization by relationship), and it is assumed that both modes of cognition permeate everyday cognitive activity. The GEOCAT was designed to measure primary and secondary processes outside the context of psychoanalytic practice. Two variants of the GEOCAT have been developed, each consisting of a list (list 1 and 2) of six categorization items.

In this study, we investigate the construct validity and internal consistency of the GEOCAT, and we check whether previously observed correlations of attributional and relational cognition with age and gender can be replicated. The data used were collected in a sample of 399 university students. In addition to the GEOCAT, we also administered the GEOSCALAR. The GEOSCALAR uses the same geometric figures as the GEOCAT but asks participants to make similarity judgments on a continuous scale and does not require the participant to choose one mode of categorization as *more similar* than the other, as is the case in GEOCAT.

### *Descriptive Statistics and Correlations With Biographical Variables*

Overall, the results indicate that participants made significantly more relational similarity judgments than attributional similarity judgments. Brakel (2004) observed a similar judgment pattern in young adults. Following previous research (Brakel, 2002, 2004), we hypothesized that similarity preferences would not be related to gender (Hypothesis 1). The results indicate that in our sample (which was 86.8% female), gender did not affect similarity judgment scores.

Next we hypothesized that there would be an effect of age on similarity judgment, that is, that the group with more relational judgment is older (Hypothesis 2), whereas the group with more attributional choices is significantly younger (Hypothesis 3). Both hypotheses were supported in the data. However, the group with more relational choices did not differ significantly in age from the group with an equal amount of relational and attributional choices. We find it remarkable that despite the relative homogeneity in age in our sample, a significant effect of age on similarity judgment was observed. This could suggest that in late adolescence and young adulthood, a further cognitive shift toward relational preference takes place, perhaps prompted in our sample by the transition from high school to university.

As the GEOSCALAR was administered in combination with the GEOCAT, we also examined whether an order effect was present. In line with our hypothesis (Hypothesis 4), no order effect was observed for the GEOCAT and GEOSCALAR attributional similarity scores. However, for the GEOSCALAR relational similarity scores, an order effect was observed. This finding is of interest: Participants who first completed the GEOCAT had higher GEOSCALAR relational similarity scores, whereas no order effect was present for the other subscales. This effect could perhaps be understood in terms of familiarization. The relational score on the GEOSCALAR is thought to require more reflective conscious thought, so it would seem that when an item that is comparable to an item one was first familiarized with in the GEOCAT appears again in the GEOSCALAR, it is thought of as more similar. Obviously, this effect is not at work for attributional similarity judgment, which, in theory, is understood to be less reflective.

If we accept that relational similarity judgment reflects a measure of the secondary process and that attributional similarity judgment reflects a measure of the primary process, the results may indicate that these processes function independently. The results may also indicate that the primary process is quite stable, functioning as a structural characteristic or a trait, while the secondary process functions in a manner that is more contingent and sensitive to contextual elements. The fact that relational scores are sensitive to small age differences in this group of young adults, while attributional scores are not, could be interpreted along the same lines. From this point of view, the GEOSCALAR could be considered as a promising complement to the GEOCAT, particularly as it measures attributional and relational similarity independently. The fact that the scores for attributional and relational similarity are uncorrelated in the GEOSCALAR (i.e., when these processes are given the opportunity to be expressed independently) further underscores the importance of the instrument.

### *Construct Validity and Reliability*

In terms of construct validation, we first examined the two assumptions that underlie this instrument: (a) that a dimension reflecting relational and attributional categorization processing lies behind the items (Hypothesis 5), and (b) that the items of both lists are equally good indicators of these processes (Hypothesis 6). A confirmatory factor analysis for binary items indicated that both assumptions hold true. The items of List 1 fit very well to the assumed latent model, and for the items of List 2, the fit is acceptable. For all GEOCAT items, substantial amounts of variance were explained by the model, and all items proved to have adequate factor loadings.

As a next step in validating the GEOCAT, we examined correlations with the GEOSCALAR, our alternative measure of similarity judgment that uses a continuous scoring scale. In line with our hypothesis correlations between corresponding GEOCAT

and GEOSCALAR subscales were significant (Hypothesis 7) but moderate in magnitude (.34 and .36). These correlations are in line with what is generally observed for concurrent measures with different methods of the same construct (Achenbach, Krukowksi, Dumenci, & Ivanova, 2005).

ANOVAs were performed to test the assumption that participants who make more attributional similarity judgments on a GEOCAT item also have corresponding GEOSCALAR attributional scores, lower GEOSCALAR relational scores, and vice versa (Hypothesis 8). The results indicated three items for which this assumption does not hold true: Item 2 from List 1, and items 5 and 6 from List 2. We suggest removing these items from the pool of GEOCAT items.

Finally, in terms of reliability, we examined the instrument's internal consistency. In line with our hypothesis (Hypothesis 9), internal consistency proved to be adequate for both lists of GEOCAT items.

We conclude that 9 items out of the set of 12 items in the GEOCAT are useful and valid indicators of relational and attributional similarity preference. As our findings indicate that Item 2 from List 1 and items 5 and 6 from List 2 are poor indicators of relational and/or attributional similarity preference, we recommend excluding these from the scale.

### *Limitations of This Study*

Limitations of this study are the strict reliance of self-report measures and the limited use of concurrent measures for primary and secondary process thinking. We made use of the GEOSCALAR as a concurrent measure of primary and secondary process thinking. However, in terms of content the GEOSCALAR is very similar to the GEOCAT and it has not yet been validated.

### *Challenges for Future Research*

Future research could make an additional step in validating the GEOCAT by examining the convergence between GEOCAT scores and scores from Holt's (2007, 2009) PriPro coding system and Martindale's (1975, 1990) Regressive Imagery Dictionary. In addition to administering the GEOCAT, researchers could also administer a TAT, which could then be coded with PRIPRO and the Regressive Imagery Dictionary. Convergence between different measures of the same construct is crucial for endorsing an instrument's validity, that is, that the measure succeeds in tapping into the concept it was designed to assess.

We also believe that it is important to develop alternative measures of relational and attributional similarity assessments. This would not only offer researchers the opportunity to further validate the GEOCAT but also broaden the field of research on primary and secondary processes in mental functioning. Building on Freud's theory that primary and secondary processes constitute mechanisms that determine how *verbally* structured ideas are psychically processed, it would be interesting for new measures to use words rather than geometric figures. Such measures could use an identical format as the GEOCAT, but participants could be presented with a word cue and asked to indicate which of two alternative words is most similar to the reference word. For example, they could be presented with the cue "beer" and asked which word is most similar: "deer" or "wine." Both alternatives have an equal number of phonemes but differ in that the first alternative builds on homophony and is not semantically related to the cue, while the second

alternative is semantically related to the cue but unrelated at the phonetic level. In this example, the first alternative builds on what Freud (1900/1953) calls the perceptual identity of the word and reflects primary process functioning. The second alternative builds on the thought identity of the word and thus reflects secondary process functioning. With this type of measure, research on similarity judgment could be broadened and related more straightforwardly to Freudian theory, with its accent on the verbal side of mental representations. Indeed, Villa, Shevrin, Snodgrass, Bazan, and Brakel (2006) carried out a subliminal priming experiment, which revealed that a subliminal prime word (e.g., "dog") proved to activate the meaning of its palindrome (e.g., "god"), while the same prime word shown supraliminally did not (Villa et al., 2006). This indicates that, at an unconscious level, word form acquires relative autonomy from word meaning. It also suggests that at a subliminal level, words function as graphemic and/or phonemic objects (Bazan, 2006). The question as to whether preference for relational or attributional similarity judgment reflects a stable psychological trait or a state that is situationally determined could also be investigated in further research. Stability of response patterns over time should be addressed and could be compared to the relative stability of PRIPRO scores, for example.

### *Working With the GEOCAT*

We believe that the nine GEOCAT items that stood our construct validation and reliability tests make up a good instrument for measuring two modes of cognitive processing that correspond with the psychoanalytic notions of primary and secondary processing, respectively: attributional and relational similarity judgment. The instrument is short, administration takes approximately 2 minutes, and it is nonverbal, which implies that it is likely that scores are not affected by verbal intelligence. The fact that it is nonverbal also makes cross-cultural and cross-age comparisons possible (starting at an early age). Moreover, the pictorial stimuli also make it a nontransparent instrument in the sense that the items do not reveal what the instrument is designed to measure. This is a considerable advantage from the point of view of the instrument's validity. Nontransparency implies that the instrument is not sensitive to participants' tendency to attune their answers to what they think the researcher wants to know (see Wiggins, 1973). Nontransparency is also an advantage because it does not trigger defensive responses (or much less so than instruments with so-called face validity), which may be particularly valuable in clinical situations.

Many fields of application are open for this instrument. In addition to previous experimental, developmental psychological, and clinical uses (see Brakel et al., 2000; Brakel, Shevrin, & Villa, 2002; Brakel, 2004), the instrument can be applied in psychopathology and psychotherapy research, where it could function as an alternative to traditional measures of primary and secondary process mentation. In several ongoing research projects, the GEOCAT has already been used to measure changes in cognition that are concurrent with psychological distress. One study found that during acute psychotic episodes, psychotic patients more frequently make use of attributional cognition, pointing to a shift toward primary process functioning (Bazan et al., 2007). We suggest that change in this direction is very typical for psychological distress.

In psychotherapy research, the GEOCAT could be used to examine changes in cognition due to psychotherapy. Here, it could be assumed that successful outcome would be concomitant with increasing secondary process cognition, indicated by increased relational similarity judgments.

## References


Achenbach, T. M., Krukowksi, R. A., Dumenci, L., & Ivanova, M. Y. (2005). Assessment of adult psychopathology: Meta-analyses and implications of cross-informant correlations. *Psychological Bulletin, 131,* 361–382.

Bazan, A. (2006). Primary process language. *Neuro-Psychoanalysis, 8,* 157–159.

Bazan, A. (2007a). *Des fantômes dans la voix. Une hypothèse neuro-psychanalytique sur la structure de l'inconscient* [Phantoms in the voice. A neuro-psychoanalytic hypothesis on the structure of the unconscious]. Montreal, Canada: Editions Liber.

Bazan, A. (2007b). An attempt towards an integrative comparison of psychoanalytical and sensorimotor control theories of action. In P. Haggard, Y. Rossetti, & M. Kawato (Eds.), *Attention and Performance XXII* (pp. 319–338). New York, NY: Oxford University Press.

Bazan, A., De Kock, L., Van Draege, K., Brakel, L. A. W., Geerardyn, F., & Shevrin, H. (2007, July). Empirical evidence for primary process mentation in acute psychosis Communication at the 7th International Neuropsychoanalysis Conference, Vienna, Austria.

Brakel, L. A. W. (2002). The priority of primary process categorizing: Experimental evidence supporting a psychoanalytic developmental hypothesis. *Journal of the American Psychoanalytic Association, 50,* 483–505.

Brakel, L. A. W., Shevrin, H., & Villa, K. K. (2002). The priority of primary process categorizing: Experimental evidence supporting a psychoanalytic developmental hypothesis. *Journal of the American Psychoanalytic Association, 50,* 483–505.

Brakel, L. A. W. (2004). The psychoanalytic assumption of the primary process: Extrapsychoanalytic evidence and findings. *Journal of the American Psychoanalytic Association, 52,* 1131–1161.

Brakel, L. A. W. (2009). *Philosophy, psychoanalysis and the a-rational mind.* Oxford, England: Oxford University Press.

Brakel, L. A. W. (unpublished). GEOSCALAR. Ann Arbor, MI: University of Michigan.

Brakel, L. A. W., Kleinsorge, S., Snodgrass, M., & Shevrin, H. (2000). The primary process and the unconscious: Experimental evidence supporting two psychoanalytic presuppositions. *International Journal of Psychoanalysis, 81,* 553–569.

Brakel, L. A. W., & Shevrin, H. (2003). Freud's dual process theory and the place of the a-rational. *Behavioral and Brain Sciences, 26,* 527–528.

Brakel, L. A. W., & Shevrin, H. (2005). Anxiety, attributinal thinking and the primary process. *International Journal of Psychoanalysis, 86,* 1679–1693.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Thousand Oaks, CA: Sage.

Carhart-Harris, R., & Friston, K. (2010). The default mode, ego-functions and free-energy: A neurobiological account of Freudian ideas. *Brain, 133,* 1265–1283.

Embretson, S. E., & Resie, S. P. (2000). *Item response theory for psychologists*. Mahwah, NJ: Erlbaum.

Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *American Psychologist, 49,* 709–724.

Fast, I. (1983). Primary-process cognition. *The Annual of Psychoanalysis, 11,* 199–225.

Freud, S. (1953). The interpretation of dreams. In J. Strachey (Ed. & Trans.), *The standard ed. of the complete psychological works of Sigmund Freud* (Vol. 5, pp. 339–751). London: Hogarth Press. (Original work published 1900)

Freud, S. (1958). Formulations on the two principles of mental functioning. In J. Strachey (Ed. & Trans.), *The standard ed. of the complete psychological works of Sigmund Freud* (Vol. 12, pp. 218–226). London: Hogarth Press. (Original work published 1911)

Gill, M. M. (1988). Metapsychology revisited. *The Annual of Psychoanalysis, 16,* 35–48.

Holt, R. R. (2007). Primary process scoring for the TAT. In S. R. Jenkins (Ed.), *A handbook of clinical scoring systems for thematic apperceptive techniques* (pp. 283–292). New York, NY: Routledge.

Holt, R. R. (2009). *Primary process thinking*. Lanham, MD: Jason Aroson.

Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In: R. H. Hoyle (Ed.), *Structural equation modeling* (pp. 158–176). London, England: Sage.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling sensitivity to unparameterized model misspecification. *Psychological Methods, 3,* 424–453.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–31.

Lacan, J. (2006). The subversion of the subject and the dialectic of desire in the Freudian unconscious. In B. Fink (Trans.), *Écrits* (pp. 671–702). New York: Norton. (Original work published 1960)

Martindale, C. (1975). *Romantic progression: The psychology of literary history.* Washington, DC: Hemisphere.

Martindale, C. (1990). *The clockwork muse: The predictability of artistic change.* New York, NY: Basic Books.

Noy, N. (1969). A revision of the psychoanalytic theory of the primary process. *International Journal of Psychoanalysis, 50,* 155–178.

Peterfreund, E., & Schwartz, J. (1971). *Information, systems and psychoanalysis.* New York, NY: International Universities Press.

Rapaport, D. (1950). On the psychoanalytic theory of thinking. *International Journal of Psychoanalysis, 31,* 161–170.

Rapaport, D., & Gill, M. M. (1959). The points of view and assumptions of metapsychology. *International Journal of Psychoanalysis, 40,* 153–162.

Shevrin, H., & Fisher, C. (1967). Changes in effects of a waking subliminal stimulus as a function of dreaming and nondreaming sleep. *Journal of Abnormal Psychology, 67,* 362–368.

Stanovich, K., & West, R. (2001). Individual differences in reasoning: Implications for the rationality debate. *Behavioral and Brain Sciences, 23,* 645–666.

Suler, J. R. (1980). Primary process thinking and creativity. *Psychological Bulletin, 88,* 144–165.

Van der Linden, W. J., & Hambleton, R. K. (1996). *Handbook of modern item response theory.* New York, NY: Springer.

Villa, K. K., Shevrin, H., Snodgrass, M., Bazan, A., & Brakel, L. A. W. (2006). Testing Freud's hypothesis that word forms and word meanings are functionally distinct in the unconscious: Subliminal primary process cognition and its links to personality. *Neuro-Psychoanalysis, 8,* 117–137.

Wiggins, J. S. (1973). *Personality and prediction.* Reading, MA: Addison Wesley.