Abstract language, global perception: How language shapes what we see

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Abstract

We show that the abstractness level of words and sentences influences basic cognitive processes. In particular, we show that abstract language causes participants to pay more attention to global features in a perceptual focus task and makes them more inclusive on a categorization task, while concrete language leads to a more detailed perceptual focus and more exclusive categorizations. These effects are shown for nouns, adjectives and verbs, as well as for sentences with ambitransitive verbs.

Keywords: Language, Perception, Linguistic Relativity, Categorization, Abstract and Conrete Language

Introduction

Some words are abstract, vague and insubstantial, while others are concrete, definite and easily visualized. This much is uncontroversial (e.g., Glenberg et al., 2008). But what, if any, are the cognitive effects of abstract and concrete language use? Do people perceive the world differently after having processed abstract and concrete language? We argue that they do. More specifically, we show that abstract language results in a more global perceptual focus and more inclusive categorizations, while concrete language induces more attention to perceptual details and more exclusive categorizations. In this paper, we report on a series of experiments that, to the best of our knowledge, show for the first time that the abstractness level of words indeed influences basic cognitive processes.

Language and Thought

Our research fits in with a wider research tradition, asking whether language shapes thought. Providing a definite answer to this seemingly straightforward question has proven to be surprisingly difficult (Boroditsky, 2003: 917). Probably, the best-known interpretation of the "does language shape thought?" question is the one due to Sapir and his student Whorf: the linguistic relativity interpretation (more commenly known as the Sapir-Whorf Hypothesis), which states that systematic differences between languages give rise to systematic differences in thought between speakers of these languages (Whorf, 1956).

For a long time, research directly addressing the Sapir-Whorf hypothesis has had a somewhat negative reputation (consider, for instance, the Eskimo-words-for-snow debate; Pullum 1991), but recent work has revealed highly interesting cross-linguistic differences related to, for instance, spatial orientation (e.g., Majid et al. 2006), perception of time (e.g., Boroditsky 2001), and perception of color (e.g., Winawer et al. 2007). Nevertheless, there are arguably two basic problems with this general approach: (1) the problem of cross-translation between languages and (2) the problem that differences between languages may covary with other characteristics of populations and that such differences may not solely be attributed to linguistic differences (e.g., Ji et al. 2004).

These two problems arise when different languages are compared, but vanish as soon as we try to answer the question within a given language. The "Does language shape thought?" question then becomes: can *within-language variation* lead to differences in thought? There is a sense in which this is clearly true: as many studies in psycholinguistics and social psychology have shown, words may influence how we perceive and evaluate the world. To give but one recent example (from Labroo et al., 2008): participants that are exposed to a word like "key," are quicker in processing a picture of a lock and evaluate this lock more favorably. Studies such as these show that a *specific* word may influence the perception of a *specific* image. Put another way, in such studies (as in the majority of priming studies), the semantics of the priming words is assumed to stand in a direct relation to the effect under consideration (e.g., priming with words like "rude" and "polite" makes people behave in a more rude or polite way, Bargh et al., 1996; priming with "warmth" increases interpersonal warmth, Williams & Bargh, 2008, etc.). In this paper, however, we do not focus on the semantics of words; rather we address a more basic question, to wit: can *classes* of words (i.e., concrete or abstract ones) influence basic, general cognitive processes?

Concrete versus Abstract Language

We argue that differences in abstractness-level between words and sentences have a direct influence on basic cognitive processes. But what makes language abstract or concrete? First of all, it is intuitively clear that some words ("democracy") are more abstract and others are more concrete ("office chair"). Moreover, it is also clear that this distinction does not only apply to nouns, but to other syntactic categories as well. An adjective such as "spiritual", for instance, is intuitively more abstract than,

say, an adjective like "blond". Similarly, in the case of verbs, it seems fair to say that a verb such as "hit" is more concrete, since it describes a directly visible action, while a verb such as "hate" is arguably more abstract, referring as it does to a more global state which may last for an unspecified period of time and may be caused by a variety of reasons (cf. Semin and Fiedler, 1988).

On a sentential level, things are slightly more complex. Naturally, a sentence with many abstract words is more abstract than one with many concrete words. But are there also minimal sentential pairs that differ in their level of abstractness, while not differing in the number of abstract or concrete words that they contain? We claim that there are. For example, it can be argued that sentences with implict arguments are more abstract than sentences with explicit arguments. As it happens, ambitransitive verbs (e.g., Dixon and Aikhenvaid, 2000) offer a perfect opportunity to study this difference. Ambitransitives are verbs (such as "read") that can be used both in an intransitive ("Grandfather reads with glasses") and in a transitive way ("Grandfather reads a book") without requiring morphologic changes on the verb. In the intransitive use the direct object is left implicit, while it is made explicit in the transitive reading.

The current studies

We have just argued that there are multiple ways in which words and sentences may be assumed to be more abstract or more concrete. In this paper, we test the hypothesis that the abstractness level of language influences performance on two very different, basic cognitive tasks: the perceptual focus task (Kimchi & Palmer, 1982, see also Gasper & Clore, 2002) and the categorical inclusiveness task (Isen & Daubman, 1984, see also Smith & Trope, 2006).

In the first task, participants are confronted with a series of three abstract geometric figures such as the one depicted in Figure 1, where participants have to indicate which of two target figures is most similar to a reference figure. This reference figure always has a basic geometric shape comprised of smaller geometric figures of a different shape (e.g., a square consisting of circles). One of the target figures has the same global shape as the reference figure but is build from differently shaped subfigures (e.g., a square consisting of triangles), while the other has a different global shape but is build from the same specific subfigures as the reference figure (e.g., a triangle consisting of circles). We hypothesize that participants that have just processed abstract language are more likely to match figures based on the global, overall shape, while participants confronted with concrete language will match figures more often based on the local details of the figures.

The second cognitive task is categorization. Are penguins birds? Intuitively, penguins are moderate exemplars of the bird category, having many global bird-like properties (they have wings and feathers, lay eggs, etc.) but also lacking some properties (most notably: they don't fly). We hypothesize that participants who have just processed abstract language are more likely to take a global, holistic view (penguins share many global features with birds) and hence will be more inclusive in categorization, while participants primed with concrete words will pay more attention to local differences and as a result will be less inclusive. These hypotheses are tested in four experiments, where participants are primed with abstract or concrete nouns (Experiment 1), adjectives (Experiment 2), verbs (Experiment 3) and ambitransitives (Experiment 4) via different priming methods. Following this, participants will perform both the perceptual focus and categorical incluviness task, in addition to various self-report measures.

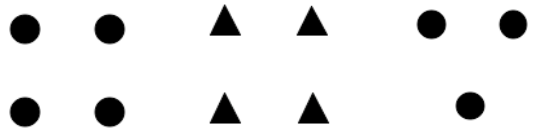

Figure 1: An exmple trial of the Perceptual Focus Task, with one reference figure (left), a global match (middle) and a local match (right).

Experiment 1: Nouns

Method

Participants Participants were 47 undergraduate students from Tilburg Unversity who participated for course credits. All were native speakers of Dutch.

Materials Two lists of seven words were compiled, one with concrete and the other with abstract nouns. The concrete list included nouns such as "dishwasher" and "office chair" and the abstract one contained nouns like "democracy" and "hypothesis".[1] A pre-test confirmed that people indeed rated these words as highly concrete and highly abstract respectively. In addition, a control list was compiled consisting of seven words of varying abstraction levels and belonging to different syntactic categories. The influence of nouns on basic perceptual processes was assessed using a 24-item perceptual focus questionnaire based on Kimchi and Palmer (1982) and Gasper & Clore (2002), in which participants had to match one of two geometrical figures with a reference figure, and a 12-item categorical inclusion task (with weak, moderate and strong examplars for four categories) derived from Isen and Daubman (1984) and Smith and Trope (2006). For the latter questionnaire, participants had to indicate whether an item (e.g., penguin) belonged to a given category (bird) on a scale ranging from 1 (definitely does not belong to this category) to 9 (definitely does belong).

Procedure Participants were randomly assigned to one of the experimental conditions. After they arrived in the experimental laboratory, they were seated in individual

[1] Here and elsewhere English translations of Dutch originals are given. The complete list of stimuli can be obtained from the authors.

cubicles and told that they would work on a series of unrelated tasks. A filler task preceded the actual manipulation, in which participants were shows a random sequence of 10 letters and asked to form six words of at least three letters from these. The second task (and experimental manipulation) consisted of a memory task, in which participants were asked to memorize the seven words on their list. They were told they would be asked to recall these seven words later in the experimental session. Next, participants performed the perceptual focus and the categorical inclusiveness tasks (in that order), which were presented as two more unrelated tasks. After this, participants performed the memory test; all were able to recall at least six items correctly. Following this, participants answered the following question on a scale ranging from 1 (local) to 9 (global) "When you did the shape task, to what extent did you focus on local matches (e.g., a square of triangles goes with a triangle of triangles) or global (e.g., a square of triangles goes with a square of squares)?" In addition, participants were asked to indicate their current mood on a scale ranging from 1 (negative) to 7 (positive) by answering the question "How negative or positive do you feel at this moment?" This was done to rule out possible mood confounds on the other questionnaires. Indeed, analysis revealed that priming had no effect on mood ($F < 1$), and therefore this measure is not further discussed. Finally, on completion of all tasks and questions, participants were carefully debriefed about the goal and purpose of the experiment, following the debriefing procedure for priming experiments (Bargh & Chartrand, 2000). None of the participants indicated suspicion of the actual goal of the study, and none suspected connections between the various tasks. After debriefing, participants were thanked for their participation and dismissed.

Design and Analyses The first experiment had a between participants design with Condition (levels: Abstract, Concrete, Control) as the independent variable, and number of global matches on the percepual focus task, average inclusiveness score on the categorical inclusive task and global self-report as the dependent variables. To test for significance, Analyses of Variance (ANOVA) were used.

Table 1: [Nouns] Average number of global matches on the perceptual focus task, local-global self-report scores and categorical inclusiveness scores as a function of condition (standard deviations between brackets).

	Concrete	Control	Abstract
Global match	11.1 (2.6)	12.6 (1.1)	16.2 (3.1)
Self-reports	4.9 (1.7)	6.1 (0.9)	7.3 (1.2)
Inclusiveness	4.9 (0.8)	6.0 (0.9)	6.6 (0.9)

Results and discussion

Table 1 summarizes the results. As predicted, priming affected the number of global choices in the perceptual focus task, where participants primed with abstract nouns were more likely to use the global form as a basis for matching figures (M = 16.2, SD = 3.1) than participants primed with concrete nouns (M = 11.1, SD = 2.6), with the control condition (M = 12.6, SD = 1.1) in between, $F(2, 44) = 17.70$, $p < .001$, $\eta^2 = .45$. As can be seen in Table 1, participants' self-reports mirror this pattern, $F(2,44)= 13.79$, $p < .001$, $\eta^2 = .39$. A partial correlation analysis with condition as control variable revealed a high correlation between these two measures ($r = .86$, $p < .001$).

Moreover, priming also influenced the average inclusiveness scores in the predicted manner: participants in the abstract noun condition were more inclusive (M = 6.6, SD = 0.9) than participants in the concrete noun condition (M = 4.9, SD =1.7), with the control condition sandwiched in between (M = 6.0, SD = 0.9), $F(2, 44) = 12.63$, $p < .001$, $\eta^2 = .37$.

The first experiment clearly confirmed our hypotheses about abstract versus concrete language and their impact on perceptual focus and categorical inclusiveness for nouns. In the next experiment we will see whether the same applies to adjectives.

Experiment 2: Adjectives

Method

Participants Participants were 49 undergraduate students from Tilburg Unversity who participated for course credits. All were native speakers of Dutch, and all were different from those who participated in Experiment 1.

Materials Again, two lists of seven words were compiled, this time with concrete and abstract adjectives respectively. The former included adjectives like "blond" and "old", the latter adjectives such a "hearty" and "idle". Pre-testing confirmed that the seven concrete and abstract adjectives were indeed rated as such by independent participants. The control condition and the remainder of the materials were as in Experiment 1.

Procedure The procedure was identical to the one of Experiment 1, with the sole difference that in Experiment 2 participants in the concrete and in the abstract condition were asked to memorize seven adjectives instead of nouns. Again all participants remembered at least six of the words from the memory test. Priming with adjectives had no effect on mood (F = 2.82, n.s.). Funneled debriefing showed that none of the participants suspected priming had an influence on their scores on any of the dependent measures.

Design and analyses As above.

Results and discussion

The results are summarized in Table 2, and are highly consistent with those of the previous experiment. As expected, participants primed with abstract adjectives were

more likely to use the global form as a basis for matching figures (M = 16.8, SD = 2.9) than participants primed with concrete adjectives (M = 11.3, SD = 1.8), with the control again in between (M = 12.5, SD = 1.1), $F(2,46) = 18.68$, $p < .001$, $\eta^2 = .49$. The self-report scores mirror this result once again, $F(2,46) = 10.05$, $p < .001$, $\eta^2 = .30$. These two factors correlate well ($r = .71$, $p < .001$).

Priming also influenced the average inclusiveness score in the expected way. Participants in the abstract adjective condition are more inclusive (M = 7.0, SD = 1.1) than participants in the concrete adjective condition (M = 5.1, SD = 2.1), with the control condition nicely in between (M = 5.8, SD = 1.0), $F(2, 46) = 6.53$, $p < .01$, $\eta^2 = .22$.

Experiment 2 replicated the findings of Experiment 1: what applies to abstract and concrete nouns also seems to apply to abstract and concrete adjectives. In Experiment 3, we investigate whether abstract (state) and concrete (action) verbs have the same effects.

Table 2: [Adjectives] Average number of global matches on the perceptual focus task, local-global self-report scores and categorical inclusiveness scores as a function of condition (standard deviations between brackets).

	Concrete	Control	Abstract
Global match	11.3 (1.8)	12.5 (1.1)	16.8 (2.9)
Self-reports	5.3 (1.8)	5.9 (1.0)	7.4 (1.2)
Inclusiveness	5.1 (2.1)	5.8 (1.0)	7.0 (1.1)

Experiment 3: Verbs

Method

Participants Forty-two undergraduate students, all native speakers of Dutch, participated for course credits, all different from those of Experiments 1 and 2.

Materials For Experiment 3, lists of concrete and abstract verbs were constructed. For concrete verbs, seven action verbs were selected from examples in Semin and Fiedler (1988), including "walk" and "laugh". For the abstract list, state verbs such as "hate" and "trust" were chosen from Semin and Fiedler's inventory. The words in the control were the same as before, as were the rest of the other materials.

Procedure For this experiment, priming was done using a word search puzzle, where participants were asked to find the seven words on their list in a large collection or randomized letters. The word search followed the filler task and preceded the dependent measures, which were the same as in the previous two experiments. Priming had no effect on mood (F = 1.97, n.s.). The debriefing revealed that none of the participants suspected any relation between the various parts of the experimental set-up.

Design and analyses As above.

Table 3: [Verbs] Average number of global matches on the perceptual focus task, local-global self-report scores and categorical inclusiveness scores as a function of condition (standard deviations between brackets).

	Concrete	Control	Abstract
Global match	11.0 (1.9)	12.8 (1.3)	15.2 (1.7)
Self-reports	4.7 (1.4)	5.9 (1.4)	7.2 (1.3)
Inclusiveness	4.9 (0.8)	5.7 (0.9)	6.9 (0.8)

Results and discussion

The results for verb priming are summarized in Table 3, and are remarkebly consistent with those for nouns and adjectives. Participants primed with abstract (state) verbs are more likely to make global matches in the perceptual focus task (M = 15.2, SD = 1.7) than those primed with control words (M = 12.8, SD = 1.3) or with concrete (action) verbs (M = 11.0, SD = 1.9), $F(2, 39) = 23.6$, $p < .001$, $\eta^2 = .55$. The scores for the self-reports show a highly similar picture, $F(2, 39) = 11.78$, $p < .001$, $\eta^2 = .38$, and indeed the two correlate strongly ($r = .92$, $p < .001$).

For inclusiveness, it was found, as expected, that participants primed with abstract verbs were more inclusive (M = 6.9, SD = 0.8) than those primed with concrete verbs (M = 4.9, SD = 0.8), with those primed with control words (M = 5.7, SD = 0.9) in between these two extremes, $F(2, 39) = 22.45$, $p < .001$, $\eta^2 = .53$.

The results for verbs offer clear evidence for our hypotheses about abstract and concrete language and their impact on perceptual focus and categorical inclusiveness. While the observed effects are a little stronger than those for adjectives, the overall pattern is the same. So far we have looked at words; in the fourth and final experiment we turn to sentences.

Experiment 4: Ambitransitives

Method

Participants Participants were 54 undergraduate students, all native speakers of Dutch who participated for course credits. None had participated in any of the other experiments.

Materials For this experiment two lists of seven sentences of comparable overall length were constructed around ambitransitive verbs. In the abstract version, verbs were used in their intransitive form followed by some modifier phrase, e.g., "Romeo loves with heart and soul" and "He eats in the canteen". In the concrete version, the verbs were used in a transitive way and the modifiers were replaced with overt direct objects, as in "Romeo loves Julliet" and "He eats a sandwich." Care was taken that overall the direct objects and modifiers were of a comparable abstractness level, and that the sets of sentences in both conditions were

equally long. Participants were instructed to learn their seven sentences by heart, and were tested on their recall at the end of the experiment. All participants remembered six or seven sentences correctly, although occassionally in slightly different wordings. The control condition and other materials were as in Experiments 1 and 2.

Procedure The procedure was identical to that of Experiments 1 and 2. Priming in the different conditions had no effect on self-reported mood scores (F = 1.23, n.s.) and funneled debriefing revealed that none of the participants had any suspiscions about the experimental set-up and the relation between the various tasks they had to perform.

Design and analyses As above.

Table 4: [Ambitransitives] Average number of global matches on the perceptual focus task, local-global self-report scores and categorical inclusiveness scores as a function of condition (sds between brackets).

	Concrete	Control	Abstract
Global match	12.2 (3.1)	12.9 (1.7)	14.9 (2.7)
Self-reports	5.3 (1.4)	6.3 (1.8)	6.8 (1.5)
Inclusiveness	5.4 (1.0)	6.3 (0.9)	6.9 (0.8)

Results

Table 4 summarizes the results, and reveals the same pattern as before. As hypothesized, priming with abstract, intransitive sentences (with implicit direct objects) leads to more global matches in the perceptual focus task (M = 14.9, SD = 2.7) than priming with concrete, transitive sentences (with explicit direct objects) (M = 12.2, SD = 3.1), with the control condition again in between the two (M = 12.9, SD = 1.7). This effect was found to be statistically significant, $F(2, 51) = 5.43$, $p < .01$, $\eta^2 = .18$. The self-reported scores reveal a comparable distribution, $F(2, 51) = 4.45$, $p < .05$, $\eta^2 = .15$, and these scores correlate fairly well with the scores on the perceptual focus task ($r = .37$, $p < .01$).

On the inclusiveness task, it was found that, as hypothesized, participants primed with abstract language (here intransitive uses) are more inclusive (M = 6.9, SD = 0.8) than those primed with concrete language (transitive uses) (M = 5.4, SD = 1.0), again with the control condition between the two (M = 6.3, SD = 0.9), $F(2, 51) = 12.94$, $p < .001$, $\eta^2 = .34$.

General conlusion and discussion

In this paper we have shown for the first time that the abstractness or concreteness of words and sentences has a significant influence on two different basic cognitive processes. In particular, we showed that after being primed with abstract words (be it nouns, adjectives, verbs or intransitively used ambitransitives), participants, as predicted, made more global matches in the perceptual focus task and were more inclusive on the categorical inclusiveness task, while participants that were primed with concrete words made more local matches and were less inclusive in each of the four experiments. Participants that were primed with control words always scored in between these two extremes. It is worth emphasizing that these effects cannot be attributed to a direct semantic link between the prime words and the observed effects. Rather these effects show that *classes* of words can indeed influence basic cognitive processes. Our results thus show that language-internal differences can indeed influence aspects of thought (perceptual focus, categorization).

Meta-analysis

Does it matter whether participants are primed with verbs, adjectives, nouns or sentences with ambitransitives? To find out we ran a statistical meta-analysis, combining data of the four experiments, which we submitted to a 4 (Experiment) by 3 (Condition: Concrete, Control, Abstract) ANOVA, using Tukey's HSD test for pairwise comparisons. As expected, condition has a significant influence on the number of global matches, $F(2, 180) = 56.00$, $p < .001$, $\eta^2 = .38$ (all pairwise comparisons significant at $p < .01$), on the local-global self-report scores, $F(2, 180) = 36.83$, $p < .001$, $\eta^2 = .29$ (all pairwise comparisons significant at $p < .001$) and on the inclusiveness scores, $F(2, 180) = 42.98$, $p < .001$, $\eta^2 = .32$ (all pairwise comparisons significant at $p < .001$). Interestingly, Experiment showed no significant main or interaction effects on any of the dependent variables (Fs < 1 in all three cases). This shows that the effects reported in this paper are relatively robust and independent of linguistic categories.

About words

Linguists have long wondered what linguistic categories really are (e.g., Chomsky, 1970; Croft, 1991; Baker, 2003). Most agree that nouns, verbs and adjectives truly are different things. Baker (2003), for instance, argues that nouns [+N] are used to refer ("have a referential index"), while verbs [+V] are used to predicate ("have a specifier"), and adjectives are simply neither nouns nor adjectives [-N, -V]. This characterization allows for a general distinction between classes of words, which has clear consequences for the syntactic organization of the world's languages. However, from a cognitive perspective, such characterizations are not the only ones that matter. As we have argued in this paper, words also differ along the abstract-concreteness dimension and this distinction cuts right across syntactic categories. Interestingly, a distinction between concrete and abstract words is also made in the Linguistic Categorization Model (LCM, see e.g., Semin & Fidler, 1988; Stapel & Semin, 2007), where it is argued that adjectives are abstract while verbs are more concrete. Our results indicate that both adjectives and verbs can be abstract or concrete, and we found that the respective impact on the two cognitive processes under consideration was not significantly different for verbs and adjectives.

Future research

At least two questions for future research naturally suggest themselves. First of all, there is the question what exactly is the underlying cause of the effects we have described. We conjecture that the following might be going on. A crucial point seems to be that abstract words are generally more difficult to visualize, while concrete words are often very easy to visualize (to see this, it is worthwhile to just type in "hypothesis" and "office chair" in Google Image Search and compare the results). In addition, we assume that linguistic and perceptual representations are linked (e.g., Barsalou, 1999). Concrete words thus may lead to easier and more specific visualizations, and hence enable more attention to detail, while abstract words arguably result in less easily obtained and more global visualizations. However, the details of this process are not well understood yet. Second, what are the consequences of this result? Do people that are primed with abstract words perform certain tasks differently from those that were primed with concrete words? We would predict that due to the differences in perceptual focus, abstract-primed participants might, for instance, solve creative puzzles in a different way from concrete-primed participants.

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