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Brief article

Mental representations of social status

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Abstract

How do people think about social status? We investigated the nature of social status and number representations using a semantic distance latency test. In Study 1, 21 college students compared words connoting different social status as well as numbers, which served as a control task. Participants were faster at comparing occupations and numbers that were semantically farther apart relative to those more closely related. In Study 2, we examined the semantic distance effect for a social status category, for which participants have as much knowledge of, as with numbers. We asked 15 US Navy Midshipmen to compare the social status associated with different ranks in the Navy as well as compare number magnitudes. Participants were fastest when comparing ranks far in status relative to ranks close in status. These findings reveal that humans have mental representations of social status that share properties with that of number.

Keywords: Mental representations; Social status; Semantic distance latency test

1. Introduction

A crucial skill used in daily social life is recognizing one's own status and the status of others within a group. Research in animal and human social organization suggests that status or rank relations permeate group structure for several reasons. Ranking allows individuals to have a set of expectations about their own role and the role of others during group situations (Ridgeway & Diekema, 1989). High-rank individuals often have preferential access to precious resources such as food, land, information or social respect. They also have the ability to elicit imitative behavior from those of lower rank.

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Meanwhile, low-rank individuals expect a certain degree of protection and care by those of higher rank (Fiske, 1992). Thus, an individual's ability to recognize status relationships is a critical part of successful social interaction and group functioning.

Comparative psychologists argue that non-human primates use mental representations to store and retrieve knowledge about their own and others' rank in the social hierarchy. Numerous studies have shown that monkeys have abstract concepts and use them to classify physical entities, such as objects, in the world (Cheney & Seyfarth, 1990). Monkeys' mental abilities for object representation and recognition apply to the knowledge domain of conspecifics and the social relations between them. For example, monkeys can identify mother–offspring pairs, ranks of individual monkeys within their group, and peers. Furthermore, the ability to attend to and distinguish between these kinds of relationships is based not on simple association mechanisms but instead on more abstract representations (Cheney & Seyfarth, 1990).

Humans also have mental representations for knowledge about non-social domains ranging from the abstract, such as numbers and letters in the alphabet (Birbaum & Jou, 1990; Dehaene, Bossini, & Giraux, 1993; Moyer & Landauer, 1967), to the perceptual, for example hue, and size (Moyer, Bradley, Sorensen, Whiting, & Mansfield, 1978). The nature of mental representations for various conceptual domains is revealed by the cognitive mechanisms that operate on them. For instance, when comparing numbers ranging from 0 to 100, people are faster at comparing 5 with 100 as opposed to 5 with 6. The amount of time it takes to compare two numbers is an inverse function of how much numerical distance separates those numbers (Koechlin, Naccahe, Block, & Dehaene, 1999; Moyer, 1973; Moyer & Landauer, 1967). Numerous studies investigating this numerical distance effect have further shown that mental representations of number are symbolic, amodal, and analogical (Dehaene et al., 1993; Moyer, 1973). The distance effect has also been demonstrated for knowledge of other non-social domains, such as letters in the alphabet and the relative size of objects, so long as the exemplars within that domain can be compared on a shared dimension (Birbaum & Jou, 1990).

Given the existence of mental representations for status knowledge in non-human primates and the evolutionary importance of this knowledge to navigating primate social relations, we hypothesize that humans also have internal representations of social status knowledge. The goal of the following studies is to investigate the nature of mental representations of status by assessing to what extent these representations are similar or distinct from those of non-social knowledge, such as number.

2. Study 1: university status and number

In Study 1, we investigate the existence of a semantic distance effect for social status, defined by various occupations in a university. We hypothesized that if occupations associated with different levels of social status were stored as symbolic, analogical representations, comparing two occupations of vastly different social status (i.e. president and janitor) will be a faster judgment than a comparison between occupations of similar social status (i.e. assistant and associate professor).

2.1. Method

2.1.1. Participants

Twenty college undergraduates between the ages of 18 and 20 years participated in the study ($M = 18.73$, SD = 0.195).

2.1.2. Materials

Eighteen nouns describing different occupational positions within a typical university setting (see Table 1) and 66 numbers ranging from 33 to 99 presented in word form were used.

Each word and number represented one of three distance categories: close, medium and far. Category membership for each number was determined by its semantic distance from "65". Category membership for each different occupational position was determined uniquely for each participant by using that individual's explicit knowledge about the semantic distance of each noun from the anchor noun, "assistant professor". Words in each category were matched for mean word length.

2.1.3. Procedure

The study consisted of a computerized task followed by a questionnaire. For each trial, the target stimulus was presented on a computer screen for 500 ms followed by a series of fixation crosses, each presented for 500 ms (ISI = 500 ms). In the number condition, participants were asked to judge whether or not the number presented was greater than, less than or equal to '65'. For the status condition, a word describing a university occupation was presented and participants were asked to decide whether or not that occupation was greater than, less than or equal to the status of an 'assistant professor'.

Following the computerized task, participants filled out a brief questionnaire asking them to assess their confidence in their comparative judgments. The questionnaire also queried participants' explicit knowledge about the relationship between the university positions by asking participants to list in rank order each position from least to greatest amount of social status. Each individual's explicit ranking of positions later served as the objective measure by which status word trials were subsequently categorized by distance from the anchor word 'assistant professor'.

Table 1
Sample stimuli for Studies 1 and 2

Distance	Domain		
	Number	University status	Navy rank
Same	Sixty-five	Assistant professor	
Close	Sixty-six	Associate professor	
Medium	Forty-five	Dean	
Far	Thirty-three	Secretary	

2.2. Results

Of the 21 participants, only 11 participants' data were used in the final data analysis. Participants were excluded from the data analysis if their explicit ranking of the social status words created a list where the judgment anchor, "assistant professor", was not in the middle. Since each individual's ranking of the status words was used to determine distance category membership for the words, a ranking where the anchor was not in the middle would yield distance categories with an unequal number of trials. Thus, only participants whose explicit rankings allowed for balanced distance categories were included in the final analysis described below.

Mean reaction times[1] were calculated for each participant using correct trials across distance levels from each condition and are shown in Fig. 1a. To test whether or not reaction time varied as a function of type of knowledge domain or semantic distance within domains, a two-factor ANOVA was conducted on the mean reaction times for both the status and number (domain factor) conditions across the three semantic distance levels (distance factor): close, medium and far. Significant main effects for distance and domain were found ($F(2,60) = 28.15$, $P < 0.034$ and $F(1,60) = 49.23$, $P < 0.02$, respectively). There was no significant interaction between domain and distance ($F(2,60) = 0.288$, $P = 0.751$). Thus, participants were faster comparing status words and numbers that were semantically farther apart. Participants were also faster to compare numbers, overall, relative to the status words. The relationship between distance and reaction time did not vary as a function of domain.

Mean accuracy scores were then calculated for each participant across distance levels for both the number and status word conditions. To test whether or not accuracy varied as a function of type of domain or semantic distance within the domain, a two-factor ANOVA was conducted on the mean accuracy scores with domain and distance as the two factors. Both main effects of distance and domain were not significant ($F(2,60) = 1.76$, $P = 0.362$ and $F(1,60) = 5.4$, $P = 0.146$, respectively). However, the interaction between distance and domain was statistically significant ($F(2,60) = 7.57$, $P < 0.001$), suggesting that the relationship between distance and accuracy varies as a function of the domain.

To determine whether or not individual accuracy across distance levels predicts reaction time, a standard linear regression was performed on the entire data set. For this analysis, a significant relationship was found between accuracy and reaction time ($R = 0.552$, $F(1,65) = 28.1$, $P < 0.0001$).

After the computer task, participants gave confidence ratings for their comparison judgments in the social status and number conditions. A significant difference was found between confidence ratings for judgments of social status ($M = 4.73$, SD = 1.09) and number ($M = 6.28$, SD = 0.70) stimuli ($t(19) = -5.29$, $P < 0.0001$). Participants self-reported more confidence with comparative judgments about numbers relative to social status words.

[1] Reaction time data underwent logarithmic transformation to reduce skewness of latency distributions (Fazio, 1990).

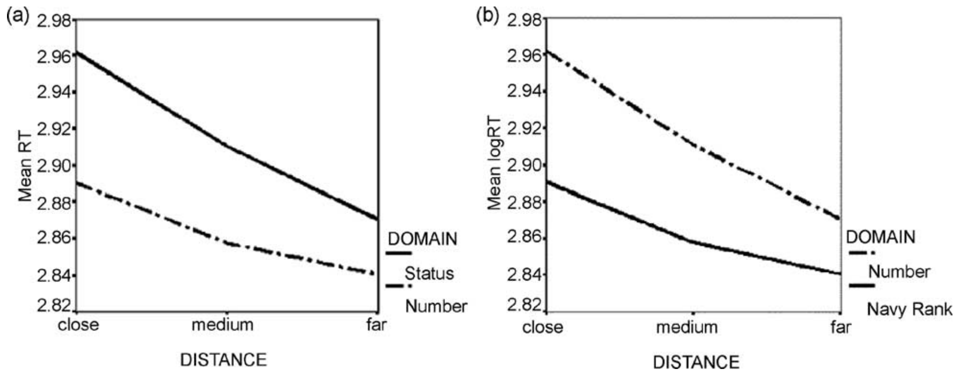

Fig. 1. Mean comparison reaction time for (a) number and status judgments and (b) number and Navy rank judgments.

2.3. Discussion

The reaction time differences due to semantic distance for both the number and status word conditions provide initial evidence for analogical mental representations of both types of categories.

There is a possible alternative explanation for the main effect of distance observed in both domains that is not related to the type of mental representation. Our data analyses revealed that reaction time differences are correlated with accuracy across distance levels. This correlation suggests that reaction time differences may be due to task difficulty (indexed by error rates), and not categorical distance per se. Although the reaction time means were calculated only with correct trials, the correlation suggests that not only did close judgments take longer, they were also more difficult leading to greater errors relative to the other distance conditions.

The data analyses also reveal a main effect of domain on reaction time differences. The number condition led to faster comparison judgments across distance levels relative to the status condition. One interpretation of this main effect of domain is that it provides evidence for distinct semantic domains.[2] An alternative interpretation is that the main effect of domain is a result of differences, not in representation, but in familiarity with the content of the two domains.

Mean self-reported confidence judgments show a parallel asymmetry in performance between the two domain conditions. Participants were more confident with number judgments relative to status judgments. This difference in confidence may have led to faster reaction times and accuracy scores across distance levels between the two domain conditions. Thus, in addition to semantic distance differences, reaction time results may be explained as a function of both confidence with, and accuracy for, a specific domain.

[2] A study by Vigliocco, Vinson, Damian, and Levelt (2002) examining semantic effects for two different domains, objects and actions, also interpreted their main effects of domain and distance as evidence for organizationally similar, but semantically distinct domains.

Results from Study 1 provide initial evidence for analogical, internal representations of number and social status. However, additional studies are needed to further clarify the effect of familiarity and confidence with the domain of status on subsequent reaction time differences.

3. Study 2: Navy rank and number

In Study 1, the degree of agreement and familiarity for the rank orderings of occupations between participants was less relative to the agreement for the ordering of numbers. This may be due to participants' varying expertise levels with university status hierarchies.

We controlled for the participant's level of category expertise in Study 2 by examining a category of status, US Navy ranks, where all group members, in this case US Navy Midshipmen, have explicit knowledge of the status hierarchy. In the beginning of their first year of training, US Navy Midshipmen learn the names, insignia and appropriate salutes for various ranks in the US Navy. Cadets use this knowledge in everyday social interaction with their peers, subordinates and superiors. Hence, their expertise with rank is comparable to their knowledge of number.

3.1. Method

3.1.1. Participants

Fifteen US ROTC Navy Midshipmen between the ages of 18 and 22 years participated in the study. All Midshipmen were at least in their second year of training.

3.1.2. Materials

Eleven pictures of insignia symbolizing status for all the ranks within the US Navy Commissioned Officer system and 66 numbers ranging from 33 to 99 presented in word form were used as stimuli in this experiment (see Table 1). Each word and number belonged to one of three distance categories: close, medium and far. Category membership for each number was determined by its semantic distance from "65". Category membership for each different rank position was determined by its semantic distance from "captain", a median rank.

3.1.3. Procedure

The study procedure was identical to that used in Study 1 with the exception of the task used in the status condition. As in Study 1, in the number condition, participants were asked to judge whether or not the number presented on the screen was greater than, less than or equal to '65'. However, for the status condition, a picture symbolizing the insignia used to indicate a particular US Navy Commissioned Officer rank was shown and the participant was asked to determine if that rank was greater, less than or equal to the rank of 'captain'.

3.2. Results

Of the 15 participants who we collected data from, 14 participants' data were used in the final analysis due to data loss from one participant. Unlike in Study 1, no participant's data were excluded based on explicit knowledge of rankings since there was an objective criterion for judging the status of each US Navy Commissioned Officer position within the hierarchy.

Mean reaction times were calculated for each participant using correct trials across distance levels from each condition and are shown in Fig. 1b. To test whether or not reaction time varied as a function of domain type or semantic distance within domains, a two-factor ANOVA was conducted on the mean reaction times for both the status and number (domain factor) conditions across the three distance levels (distance factor): close, medium and far. Significant main effects for distance and domain were found ($F(2,84) = 9.143$, $P < 0.0001$ and $F(1,84) = 14.258$, $P < 0.0001$, respectively). There was no significant interaction between domain and distance ($F(2,60) = 0.770$, $P = 0.467$). Thus, participants were faster comparing status words and numbers that were semantically farther apart. Participants were also faster to compare status pictures, overall, relative to the number words. The relationship between distance and reaction time did not vary as a function of domain.

Mean accuracy scores were then calculated for each participant across distance levels for both the number and status word conditions. To test whether or not accuracy varied as a function of type of knowledge domain or semantic distance within the domain, a two-factor ANOVA was conducted on the mean accuracy scores with domain and distance as the two factors. Both main effects of distance and domain were not significant ($F(2,82) = 2.168$, $P = 0.121$ and $F(1,82) = 1.009$, $P = 0.318$, respectively). The interaction between distance and task was marginally significant ($F(2,82) = 3.294$, $P = 0.05$), suggesting that the relationship between distance and accuracy slightly varies as a function of domain.

To determine whether or not individual accuracy across distance levels predicts reaction time, a standard linear regression was performed on the entire data set. For this analysis, no significant relationship was found between accuracy and reaction time ($R = 0.22$, $F(1,81) = 4.061$, $P > 0.05$).

3.3. Discussion

The reaction time differences due to semantic distance for both the number and Navy rank conditions replicate our findings in Study 1. They provide further support that knowledge of both domains involves mental representations that are analogical and symbolic.

Results from Study 2 also address whether or not the distance effect is not related to the type of mental representation but instead a function of accuracy distance across distance levels. In this study, accuracy was not significantly correlated with reaction time differences in distance. This was probably due to the fact that participants were more knowledgeable of the relationship between the different positions within the status hierarchy in Study 2 relative to Study 1.

The data analyses also reveal a main effect of domain on reaction time differences. This is a replication of a domain effect found in Study 1 and provides further evidence for the distinct semantic spaces hypothesis since knowledge and familiarity with the content of the two domains is not significantly different as it was in Study 1 (see also Vigliocco et al., 2002).

Findings from Study 2 also suggest that internal representations of social status knowledge are amodal. Although pictures instead of verbal labels were used to cue social rank in Study 2, significant main effects were still found, suggesting that when people compare ranks they access abstract representations that are distinct from the percept activating the associated semantic information. Hence, these findings support the notion that mental representations for status and number have properties that are spatially distinct, but similar (i.e. amodal, symbolic).

4. Conclusion

For both human and non-human primates, one's ability to know the status of oneself and others is critical to successful navigation of daily social relations and interaction. Despite the evolutionary importance of social status knowledge, little is known about how the human mind thinks about social status. In these two studies, we investigated the nature of human mental representations of social status.

Our results indicate that knowledge of social status is an abstract domain, like number, in that symbolic cues mediate the processing of status perception from perceptual cues (such as occupational labels and visual insignias) to an amodal, internal representation of its semantic meaning. Although both domains are organized in a similar analogical fashion, status is a domain distinguishable from number, perhaps resulting from differences in how discrete the interval boundaries within the domain of social status are relative to number.

These findings provide a starting point for future studies to investigate to what extent the domains of status and number are distinguishable by using the two semantic distance tasks used here. For example, does the distinction between the domains of status and number, of social and non-social, hold at the neural level? Is knowledge of both domains stored in similar or overlapping brain regions such as the parietal lobe (Pinel, Dehaene, Riviere, & LeBinahn, 2001)? Do comparative judgments involving knowledge of social and non-social domains rely on similar brain mechanisms? Or are semantic judgments in the parietal lobe domain-specific to number?

Our findings provide a foundation for future research addressing how mental representations for social knowledge such as status, and the neural mechanisms that support such representations, may be shared or unique to those subserving knowledge of non-social domains, such as number.

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