Measuring Associative Strength: Category-Item Associations and Their Activation from Memory

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Three measures of the strength of association between a category and members of the category were investigated: (a) a naming measure, in which the participants (93 undergraduates) were asked to list the members of a category and the listing order was assumed to reflect associative strength; (b) a latency measure, which assessed the latency to correctly identify specific items as members or nonmembers of a given category; and (c) a facilitation measure, in which the spontaneous activation of an item upon presentation of a category label as a prime was assessed by considering the extent to which the prime facilitated recognition of an initially degraded (visually obscured) item. The three measures correlated substantially, thus validating the naming and latency measures as reasonable approximations of the likelihood that a given item will receive activation in memory when the category is presented. Many of the constructs of interest to survey researchers can be viewed similarly as associations in memory, and the naming and latency measures can be fruitfully used in surveys; research attesting to the utility of naming and latency data is reviewed.

KEY WORDS: accessibility, associative strength, survey research.

The present research concerns the assessment of associative strength. Various measures of associative strength are examined, in the hope of establishing their validity as approximations of the likelihood that a given construct will be activated from memory upon presentation of the stimulus. After briefly reviewing evidence from the attitudes literature that illustrates the value of an associative perspective, we shall argue that many additional constructs of interest to survey researchers also may be fruitfully viewed as associations in memory. We will then report research aimed at validating two measures of associative strength that are sufficiently straightforward to be employed in a survey context.

The measurement of associative strength is often an important goal of survey researchers, although usually not an explicit one. Surveys seek to identify what

"comes to mind" when a given stimulus is encountered—that is, what is associated with the stimulus sufficiently strongly that it is activated from memory upon the presentation of the stimulus.

In the case of survey items that assess attitudes, the stimulus is the attitude object. For instance, political psychologists might be interested in respondents' attitudes toward various candidates for public office or toward some contemporary issue. Of interest here is the respondent's personal evaluation of the attitude object: To what extent does the attitude object evoke a positive or a negative evaluative reaction from the respondent? In other words, is the attitude object associated with a particular evaluation for that respondent?

Attitudes as Object-Evaluation Associations

Recent approaches to the attitude construct have defined attitudes as categorizations of an object along an evaluative dimension (Fazio, Chen, McDonel, & Sherman, 1982; Zanna & Rempel, 1988). Adopting such a definitional perspective, Fazio and his colleagues have proposed a model of attitudes as object-evaluation associations (Fazio, 1995; Fazio et al., 1982). An attitude is viewed as an association in memory between a given object and a given summary evaluation of the object. The strength of the object-evaluation association is presumed to vary. This associative strength determines the attitude's accessibility from memory, that is, the likelihood that the attitude will be activated automatically from memory upon the individual's encountering the attitude object (Fazio, 1993; Fazio, Sanbonmatsu, Powell, & Kardes, 1986).

Self-reported evaluations of an attitude object do not, in and of themselves, provide the survey researcher with information about the strength of such object-evaluation associations. Some survey respondents may report preexisting evaluations that they have associated with the attitude object. However, as Converse (1970) noted long ago, other respondents faced with an attitudinal query may *construct* evaluations on the spot, even though they have never before considered what their personal evaluations of the attitude object might be. Such a construction process is both effortful and time-consuming, relative to what is required when a preexisting evaluation is activated automatically from memory upon mention of the attitude object. Thus, the latency with which an individual responds to an attitudinal query can provide information about the strength of the object-evaluation association.

Attitude researchers have increasingly used latency measures as a means of distinguishing attitudinal responses that stem from strong versus weak object-evaluation associations. Initial laboratory research attested to the validity of the assumption that latencies of response to an attitudinal query are a function of associative strength. Individuals who had been induced to consolidate the information they had received about novel attitude objects, by virtue of their having to complete a single attitude measure toward each object, later exhibited faster

response latencies to attitudinal queries (Fazio et al., 1982; Fazio, Lenn, & Effrein, 1984). Similarly, individuals who had been induced to rehearse their attitudes, either by the need to copy their original attitudinal ratings onto multiple forms (Fazio et al., 1982) or by the need to complete multiple semantic differential items (Powell & Fazio, 1984), were subsequently faster to respond.

The latency with which an individual can respond to an attitudinal inquiry provides an approximation of the likelihood that the attitudinal evaluation will be activated automatically from memory upon presentation of the attitude object. Fazio et al. (1986) developed a priming paradigm for the purpose of investigating such automatic attitude activation. The participants' primary task in this procedure was to identify as quickly as possible the connotation of an evaluative adjective by pressing either a "good" or a "bad" key. However, each target adjective was preceded by a prime that the participants were to remember and recite aloud at the end of the trial. These primes were the names of attitude objects. What is of interest in this procedure is the latency with which participants could identify the adjective's connotation and, more specifically, the extent to which responding was facilitated by the prime. Greater facilitation on congruent trials (i.e., trials for which the participants' attitudes toward the primed objects were congruent with the valence of the target adjectives) than on incongruent trials implies that attitudes toward the primed objects were automatically activated from memory, even though the task did not require participants to consider their attitudes toward the primes.

In a series of experiments, Fazio et al. (1986) did observe more such facilitation on trials involving congruency. However, this effect varied as a function of the associative strength that characterized the participants' attitudes. It was more pronounced for relatively stronger object-evaluation associations. The attitude objects that served as primes had been selected idiosyncratically for each participant on the basis of the latency with which the participant had earlier indicated his or her evaluation of the attitude object. Objects toward which participants responded more readily later produced more facilitation on the evaluatively congruent trials than did those toward which they responded more slowly.

Similar effects were obtained by Sanbonmatsu, Osborne, and Fazio (1986) using a word identification task instead of the adjective connotation task. In this experiment, the target adjective initially was masked by a rectangular block of dots that gradually disappeared until the word became legible. Participants pressed a key as soon as they were able to identify the target word and then recited it aloud. Evaluatively congruent primes facilitated target identification, especially if the primed objects were ones toward which the participants could indicate their attitudes relatively quickly.

The first use of response latency in an attitudinal survey context was Fazio and Williams' (1986) investigation regarding the 1984 presidential election. During June and July 1984, shoppers at a mall were invited to participate in a short opinion survey. The participants were exposed to tape-recorded opinion statements and responded to each statement by pressing one of five buttons, labeled "strongly

agree" to "strongly disagree." Embedded among the items was the statement "A good president for the next four years would be Ronald Reagan" and a similarly worded statement regarding Walter Mondale. An electronic marker on the tape was synchronized with the candidate's name; it initiated a microprocessor's clock, which was terminated by the respondent's button press. Thus, attitudinal responses and the latency of those responses were available.

Beginning the day after the election, the respondents were telephoned and asked whether they had voted and, if so, for whom. Attitudes, despite having been assessed more than 3 months earlier, correlated substantially with voting behavior. However, latencies of response to the attitudinal statements moderated the relation. Correspondence was significantly greater among those participants who had responded relatively quickly (the high attitude accessibility group) than among those who had responded more slowly (the low attitude accessibility group). For example, nearly 80% of the variance in voting behavior was predicted by attitudes toward Reagan within the high accessibility group, as compared to 44% within the low accessibility group.

Similar findings illustrating the moderating role of response latencies in the prediction of voting behavior have been obtained by Bassili (1995) in a more traditional, computer-assisted telephone interviewing (CATI) context. The survey concerned the 1990 Ontario election. Responses and response latencies to the question "Which party do you think you will vote for?" were recorded during the 3 weeks that preceded the election. Pre-election voting intentions were more predictive of actual vote among those respondents who expressed their voting intention relatively quickly.

In summary, viewing attitudes as object-evaluation associations in memory has proven fruitful (see Fazio, 1995, for a more thorough review of relevant findings). Such a theoretical perspective highlights the importance of the accessibility of attitudes from memory and points to the potential utility of assessing not only attitudinal responses, but also the accessibility of the attitudes. Moreover, the latency of response to an attitudinal inquiry has proven to be a useful methodological tool by which the strength of object-evaluation associations can be approximated. Predictions can be improved by researchers' consideration of the latency with which attitudinal responses are made.

Although many other indices of attitude strength have received attention in recent years (Petty & Krosnick, 1995; see Fazio, 1995, for a conceptual model of such indices), research comparing multiple measures of attitude strength has found response latency to account for unique variance in attitude pliability and stability (Bassili, 1996). Response latency tends to outperform what Bassili (1996) has termed meta-attitudinal measures of attitude strength, ones that require individuals to report subjective impressions of their attitudes (e.g., perceived importance, perceived knowledgeability, perceived conflict, frequency of thought) or attitudinal processes (e.g., perceived ease with which an attitude comes to mind).

The More General Case of Category-Item Associations

Although the literature on attitude accessibility is certainly relevant to survey researchers, the interests of such researchers are not limited to attitudes. Surveys commonly inquire about the participants' beliefs. For example, political surveys sometimes include questions about the extent to which the various political candidates are characterized by specific traits or about the extent to which they espouse a particular position on some controversial issue. It is also common to ask respondents to provide an indication of how important they regard each of a set of political issues. Just like attitudes, though, beliefs have been viewed as associations in memory. According to Jones and Gerard's (1967) definition, a belief "expresses the relation between two cognitive categories" (p. 158)—the object and an attribute of the object. Thus, "a belief concerns the associated characteristics of the object" (p. 158). Ajzen and Fishbein's (1980) theory of reasoned action also defines beliefs as object-attribute associations.

Many additional examples of common survey questions that involve associations can be offered. Political surveys often ask respondents to state their political party affiliation and to assess the extent to which they view themselves as liberal or conservative. Obviously, these self-identifications can be viewed as associations in memory. In this case, the association is one that involves attributes of the self ("Me-Democrat" or "Me-Liberal").

Occasionally, respondents are asked to list objects or issues that they view as matching the criteria necessary for inclusion in some category. For example, they might be asked to identify the political issues that are likely to be pivotal or important in an upcoming election. Such a question also can be viewed as inquiring about associations. The aim is to assess the strength of association between the general category "important political issues" and potential members of that category.

Because attitudes, beliefs, self-attributes, and category membership can all be viewed as associations in memory, we refer to them collectively as *category-item associations*. In our usage, "category" can refer not only to a set of objects that share some features (e.g., "important issues"), but also to a specific object (e.g., a given political issue or the self). "Item" can refer to specific exemplars of the general category, but it also can refer to an evaluation (as in the case of attitudes and object-evaluation associations) or an attribute (as in the case of beliefs and object-attribute or self-attribute associations).

Measuring the Strength of Category-Item Associations

Just as was the case for attitudes, responses to questions of the sort mentioned above do not, in and of themselves, provide information regarding the strength of the relevant association. The respondent may have given very little a priori attention to the matter at hand. Indeed, the question itself may prompt individuals to think

about the issue more extensively or in ways that would not have occurred to them without such a prompt. In other words, instead of reporting an existing association, respondents may construct such an association in response to the very question that is being asked. Some means of discriminating these possible response processes is needed.

Obviously, one possibility is suggested by the success achieved through the use of latency measures in research concerning attitudes. One can readily imagine assessing the latency with which participants can indicate that a given "item" is a member of (or true of) a given category (e.g., "Is the candidate a Democrat?" or "Does the candidate support legalized abortion?").

A second possibility is suggested by the occasional use of more open-ended measures in survey research, ones in which respondents are asked to list their responses to a question. For example, individuals might be asked "What do you view as the important issues of our time?" The value of such open-ended measures has long been recognized. They provide a means of assessing the participants' self-generated thoughts, ones that are not cued by more specific survey questions. In the present context, however, these open-ended measures have an additional benefit. The order in which items are listed may provide information about the strength of the category-item associations. Items that involve a stronger association in memory should be characterized by an advantage in terms of their likelihood of being retrieved, and hence should be listed earlier.

This kind of "order of output" data has been used frequently as a measure of associative strength in research concerned with verbal learning (e.g., Underwood & Schulz, 1960). Published normative data regarding the likelihood of a given instance being listed in response to a given category (e.g., Battig & Montague, 1969; McEvoy & Nelson, 1982) often have been used for stimulus selection purposes in experimental research. Marketing psychologists also have used such measures as a means of assessing brand name awareness (e.g., Axelrod, 1982; Nedungadi, 1990). Order-of-listing measures also have proven informative in research concerned with individuals' social networks (e.g., Burt, 1986; Huckfeldt, Beck, Dalton, & Levine, 1995). When individuals are asked to generate names of people with whom they associate in one domain or another, the order in which those names are cited is assumed to reflect relationship strength. Research concerned with the extent to which a given trait is chronically accessible for a given individual also has considered order of listing in response to an open-ended question (e.g., Bargh, Lombardi, & Higgins, 1988; Higgins, King, & Mavin, 1982). Traits that are mentioned first when the individual is asked to list characteristics of various types of people (e.g., people they like) are presumed to be relatively more accessible than those listed later or not at all.

Thus, two general means of assessing associative strength appear viable for survey research: latency of response to a direct query, and order of listing in response to an open-ended question. Both the latency and naming measures described below are based on responses to direct inquiries about category membership.

Respondents are engaged in a deliberate search of each category to arrive at either a membership decision (yes/no) or a list of members. However, fast responses and early naming are assumed to stem from relatively strong category-item associations. Presumably, the stronger associations are such that presentation of the category name is sufficient for the item to receive some activation in memory. Such automatic activation speeds responding to the direct query and enhances the likelihood that the item will be retrieved and offered as an answer to the open-ended question. This presumption serves as the focus of the current research. The work aims to validate both measures as reasonable proxies for the likelihood that a given item will be activated spontaneously in response to the category name.

We assessed such spontaneous activation in our experiment by the extent to which the presentation of a category name as a prime facilitated the recognition of an initially degraded item, just as in the research mentioned earlier concerning the extent to which the presentation of an attitude object facilitated the recognition of a target adjective (Sanbonmatsu et al., 1986). Items were initially masked by a rectangular block of dots. These dots disappeared on a random basis, gradually making the item word more and more legible. The participants' task was to recognize the item word as quickly as possible. If the item was automatically activated in response to the primed category name, then it should take less time for the participants to recognize and identify the item than would otherwise be true, even though the participants' task did not involve their active and deliberate consideration of the primed category's members. Thus, the measure assesses the likelihood that a given item spontaneously receives some activation from memory upon the presentation of a category label, as opposed to the speed or ease with which the item comes to mind when one is deliberately attempting to retrieve category membership information from memory.

The extent to which a category name facilitated recognition of a specific item served as our measure of associative strength. With this facilitation measure, we can examine how the more deliberate search involved in the latency and naming tasks corresponds to a less conscious and more spontaneous process. In effect, this facilitation measure represents the "gold standard" to which we compare the two other measures of interest: the latency and naming measures.

The categories that served as the stimuli in our experiment were product categories, and the items were specific brand names. The use of such product category – brand name associations has a number of advantages in terms of the present aims. First, a large number of products with which people are very familiar can be identified, allowing us to include many categories in the experiment. Second, many such product categories include a large number of specific brands, making it possible to identify brands that differ markedly in their strength of association with the product category. Finally, product category membership is objectively verifiable; thus, responses can be identified as correct or incorrect.

Method

Stimulus Selection

Specific product categories and their associated brand names were selected for use as stimuli on the basis of data collected from 36 undergraduates at Indiana University. A naming task was used to establish a consensual set of brands that tend to be strongly associated with certain categories and a contrasting set of brands that tend to be only weakly associated with those categories. Participants were given a category label (e.g., "TOOTHPASTE") and asked to name aloud as many brands belonging to that category as possible in 20 seconds. After the response period, another category was announced until participants had responded to a total of 60 randomly ordered categories. All responses were tape-recorded.

Analysis of these data was designed to identify categories for which there was general agreement about both a "strong" and a "weak" associate. Designation as a strong or weak associate took into account the number of participants who named a given brand in response to the category label as well as the rank ordering of brands mentioned by each participant. Category members that were strong associates tended to be named early on most participants' lists, whereas weak associates tended to be named later (or not at all). Of the 60 categories presented, 24 were characterized by a clearly identifiable strong associate as well as an obviously distinguishable weak associate.[1] These categories and their designated brand associates are listed in Table I.

Participants

Ninety-three Indiana University undergraduates participated in the experiment. They were randomly assigned to groups that participated in the naming, latency, and facilitation tasks described below.

Procedure

Naming measure. The 31 participants assigned to the naming task completed a written version of the same task that had been used to select stimuli. Each participant received a booklet that presented one of the 24 category labels on each page (see Table I). The pages were randomly ordered for each participant. Participants were instructed to read the category label on each page and then write down

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[1] Two additional categories were included as stimuli in the subsequent experiment. However, the brands for these categories were selected for other purposes and did not represent strong versus weak associates to the category. Hence, these two categories are not included in the analyses reported here.

Table I. Selected Categories and Their Strong and Weak Associates

Category	Strong associate	Weak associate
Airlines	TWA	Pan Am
Aspirin	Bayer	Bufferin
Auto tires	Goodyear	Firestone
Beer	Budweiser	Coors
Bicycles	Schwinn	Huffy
Board games	Monopoly	Clue
Cameras	Kodak	Polaroid
Candy bars	Snickers	Butterfinger
Cigarettes	Marlboro	Kool
Coffee	Folgers	Hills Brothers
Credit cards	Visa	Diners Club
Fast food	McDonald's	Taco Bell
Frozen dinners	Swanson	Stouffer's
Gasoline companies	Shell	Marathon
Jeans	Levis	Wrangler
Magazine	*Time*	*People*
Margarine	Parkay	Imperial
Mayonnaise	Hellmann's	Kraft
Soda pop	Coca-Cola	Dr Pepper
Tennis shoes	Nike	Converse
Toilet paper	Charmin	White Cloud
Toothpaste	Crest	Close-Up
Televisions	Zenith	Magnavox
Wrist watches	Timex	Seiko

as many brand names associated with that category as came to mind. The participants were further instructed to list their responses immediately as they thought of them, rather than thinking of five or six and then writing them all down as a group. This ensured that the written responses reflected order of retrieval.

Latency measure. A second group of 31 participants performed a task in which they were directly asked whether a given brand is a member of a specified category. The participants were seated at a monitor on which category labels and brand names were presented sequentially. Each trial began with the appearance of one of the selected category labels (e.g., "TOOTHPASTE"), which remained on the screen for 750 milliseconds (ms). It was followed by a brand name that may or may not have been a member of the specified category (e.g., "CREST" or "EQUAL"). Participants were instructed to indicate as quickly as possible whether the specific brand was a member of the preceding category by pressing one of two response buttons, labeled "yes" and "no." Brand names remained on

the screen until the participant responded or for a maximum of 6 seconds. A 3-second interval separated the trials.

Each of the 24 category labels was paired once with its strong associate, once with its weak associate, and twice with brand names that did not belong to that category. Thus, category labels were followed by actual category members in half the trials and by nonmembers in the other half. Category label–brand name pairs were presented in a random order to each participant. For each trial, both the response and the response latency were recorded.

Facilitation measure. Unlike the other groups, the third group of 31 participants performed a task that did not involve any direct inquiries about category membership. The experiment, purportedly about word recognition, proceeded in two phases. The first phase was aimed at collecting initial baseline data regarding the ease with which each target brand could be recognized. Each trial began with a string of three asterisks appearing on the screen for 200 ms. The participants were told that the asterisks served as a warning signal that the trial was about to begin. After a pause of 100 ms, a brand name was presented. Initially, however, the brand name was completely masked by a rectangular block of dots. Gradually these extra dots disappeared until enough were gone that the brand name became legible. Participants were instructed to press a specified key on the computer keyboard as soon as they recognized the word on the screen. They were urged to respond as soon as they thought they could accurately identify the word and to strive to recognize each word with as many extraneous dots remaining as possible. Participants were told that while all the dots would disappear in 3 seconds, they should be able to recognize the word well before all the dots were gone. It was also stressed that the key press should be the initial indication of word recognition. After pressing the key, participants were to say the word aloud. The word and any remaining masking dots were erased from the screen as soon as the response key was pressed or after a maximum of 4 seconds. An interval of 2.5 seconds separated the trials. Verbal responses were tape-recorded, and a randomly selected subset of the tapes were checked for the accuracy of word recognitions. Errors were very rare (less than 1%). Elapsed time, from the initial appearance of the rectangular block of dots until the key press signaling recognition, was recorded by the computer.

The masked words used in these trials were strong associates, weak associates, or filler names that were not members of the selected categories. These baseline trials were designed to establish how quickly each brand name could be recognized without any preceding prime.

The second phase of the procedure was devoted to priming. Category labels were used as primes, replacing the asterisks. Participants were told that they would again be asked to recognize target words as quickly as possible, but that the task now would be a bit more complicated. Each target word was to be preceded by a "memory word" that they would need to remember until the end of the trial. Each prime was displayed for 200 ms, and after a pause of 100 ms a masked brand name appeared. As before, the extraneous dots disappeared gradually until the word

embedded in the block became legible. Participants were again instructed to press a key as soon as they could recognize the word, to say the word aloud, and then to say aloud the "memory word" that had preceded it. Each of the 24 category primes appeared a total of four times during the course of the task. Once it was followed by its strongly associated brand, once by its weakly associated brand, and twice by filler brands that were not members of the category.

Results

Naming Measure

The naming data were coded according to the order in which the items appeared in a participant's list. The brand named first received a rank of 1, the brand named second received a rank of 2, and so on. If one of the target items was not named, it received a rank equal to the rank of the brand mentioned last, plus 2. For example, if six candy bars other than Butterfinger were named, Butterfinger would have been assigned a rank of 8. Our reasoning for adding 2 (as opposed to just assigning the next available rank) was that there should be a penalty for failing to mention a brand. We then computed the mean rank across participants for each brand. The mean rankings for each category are shown in Table II, along with the results of a t test comparing the strong and weak associates. Means were in the predicted direction for all 24 categories and differed significantly in all but two cases. Averaged across categories, the brands designated as strong associates in the normative sample continued to be named significantly earlier in participants' listings ($M = 2.42$) than were the weak associates ($M = 5.11$) [$t(23) = 9.36, p < .001$]. Thus, the rankings were substantially the same as those produced in the initial normative sample. Across the 48 items, the correlation between the mean ranking obtained in the present sample and the original normative sample was .94, attesting to the reliability of the naming measure.

Latency Measure

Before the response latency scores were analyzed, they were subjected to a reciprocal transformation [i.e., 1/(latency in seconds + 1)]. Because latency distributions are inevitably skewed, this transformation serves to reduce the impact of extremely slow latencies when a mean is computed (see Fazio, 1990, for a discussion of this and other methodological issues that arise when using latency measures). Although all analyses were conducted on these transformed scores, all means reported in this paper have been converted back to the original metric for ease of comprehension. In addition, response latencies of participants who made errors (responding "no" to a category member that actually belonged to the category named) were excluded from the data set. The average number of such errors per participant was 2.10 across all trials.

Table II. Mean Naming, Latency, and Facilitation Scores for the Strong and Weak Associate Within Each Category

Category	Naming			Latency			Facilitation		
	Strong	Weak	t	Strong	Weak	t	Strong	Weak	t
Airlines	3.710	5.516	2.70*	728	742	.32	−.481	−.313	3.26**
Aspirin	2.500	4.067	3.41**	614	655	1.72	−.410	−.360	.85
Auto tires	2.600	3.967	3.76***	707	755	1.29	−.222	−.241	−.44
Beer	2.645	6.742	6.67***	620	753	4.63***	−.201	−.306	−1.74
Bicycles	1.700	3.933	10.00***	668	701	.91	−.423	−.319	2.33*
Board games	1.613	5.774	8.48***	597	721	4.72***	−.275	−.221	1.03
Cameras	2.742	4.226	3.70***	603	691	3.23**	−.376	−.226	3.75***
Candy bars	2.968	6.839	4.83***	576	812	6.58***	−.330	−.204	2.32*
Cigarettes	2.355	5.355	4.29***	687	772	2.11*	−.293	−.376	−1.43
Coffee	2.400	4.867	6.50***	705	860	2.84**	−.301	−.111	3.38***
Credit cards	1.742	6.548	9.78***	645	1087	7.21***	−.278	−.071	3.82***
Fast food	1.300	6.800	13.94***	605	732	3.21**	−.317	−.171	3.47**
Frozen dinners	2.379	4.000	4.10***	873	838	−.70	−.248	−.347	−1.81
Gasoline	2.333	4.700	5.76***	689	812	3.15**	−.231	−.099	2.60*
Jeans	2.387	6.581	7.98***	635	764	3.06**	−.283	−.316	−.60
Magazine	5.097	8.323	3.83***	632	778	4.46***	−.373	−.202	3.20**
Margarine	2.533	4.100	3.57***	781	746	−.67	−.336	−.168	4.51***
Mayonnaise	1.839	2.548	1.90	731	848	1.78	−.349	−.294	.92
Soda pop	1.581	6.516	6.83***	649	642	−.24	−.200	−.204	−.09
Tennis shoes	2.194	4.484	4.47***	664	774	3.12**	−.480	−.262	5.51***
Toilet paper	1.759	3.448	4.36***	724	778	1.42	−.295	−.191	1.88
Toothpaste	1.452	4.968	8.82***	649	672	.68	−.392	−.107	4.88***
Televisions	3.548	3.935	.70	677	791	3.09**	−.247	−.273	−.49
Wrist watches	2.742	4.452	3.02**	653	700	1.40	−.283	−.272	.18

Note. Naming scores are the mean rank at which the item was listed; lower numbers reflect stronger associations. Latency scores are the mean elapsed time before responding to the category membership inquiry (in milliseconds). Facilitation scores are the mean proportional reduction in recognition time achieved by priming the item with the category label; more negative scores reflect greater facilitation and, hence, stronger associations. The *t* ratio comparing each pair of means is listed; negative *t* values reflect a difference in the unpredicted direction.

*p < .05, **p < .01, ***p < .001.

    The mean latency score (i.e., the elapsed time until verification of category membership) for each item is listed in Table II. For 21 of the 24 categories, the mean latency was less for the strongly associated item than for the weakly associated item; this comparison was statistically significant for 13 of the categories. Averaged across the categories, the mean latency of response to questions about category membership was significantly faster for strong associates (M = 669 ms)

than for weak associates (M = 764 ms) [$t(23)$ = 5.20, $p < .001$]. Thus, the latency measure successfully differentiated strong and weak associates.

Facilitation Measure

Analyses of the data from the priming task focused on facilitation scores. The extent to which the category label (i.e., the prime) facilitated recognition of the target word was an indication of whether activation of the category member occurred as a result of the presentation of the category label. For any given brand, the facilitation measure involved the recognition time when the brand's presentation was preceded by its category label minus the recognition time when it was preceded by asterisks. However, this simple difference score is unduly influenced by differences in the ease of recognizing various items. A word that is very easy to recognize, perhaps because it is short or extremely common, cannot be expected to show, in absolute terms, as much improvement in speed of recognition when preceded by its category label as a word that is initially much more difficult to recognize. The inherent difficulty of recognizing each target item is gauged by the recognition times for the baseline trials. Recognition time for the baseline trials was indeed correlated with the facilitation difference score ($r = -.31$, $p < .025$). In other words, slower initial recognition times were associated with greater subsequent facilitation. Consequently, we decided to index facilitation relative to the length of baseline recognition by computing the ratio of the difference score to the baseline (facilitation ratio = facilitation difference score / baseline). The ratio score can be interpreted as the proportional reduction in latency of recognition when a category label appeared as a prime. This ratio measure of facilitation was uncorrelated with baseline recognition time ($r = .01$).

The mean facilitation ratio scores for each category are shown in Table II. The means were in the predicted direction for 17 of the 24 categories, and the difference achieved a conventional level of statistical significance for 12 of the categories. Averaged across the categories, significantly greater facilitation was observed for the strong associates ($M = -.318$) than for the weak ($M = -.236$) [$t(23)$ = 3.73, $p = .001$]. Thus, the facilitation measure also was successful at discriminating between those items that we had identified as strongly versus weakly associated with the category.

Correlations Among the Measures of Associative Strength

We also examined the interrelations among the three measures of associative strength. Before doing so, however, we made an adjustment to the naming scores to make their meaning more equivalent across categories. Categories varied with respect to their size. Some categories produced a large number of listings, others relatively few. In large categories, being named last or near last results in a worse rank than being named last or near last in a small category. As a result, mean rankings and category size are related. The correlation between the mean ranks and the category size (as estimated by the average number of items that were listed in

response to a category label) was .45, indicating that members of larger categories were associated with larger mean ranks. This was not an issue in the previously reported results, because comparisons were made between strong and weak associates within a given category. For the purpose of examining relations across categories, however, a naming index that is not confounded with category size (and hence does not penalize weak associates from large categories relative to weak associates from small categories) is preferable.

We adjusted for category size by considering the expected rank value for any category member, that is, the rank value that would be expected by chance in a randomly ordered listing. Normally, the expected value for ranks would be (category size + 1)/2. However, our ranking system included those target items that were not listed. If a brand was not named, it had been assigned a rank equal to the rank of the last brand mentioned plus 2. Hence, we computed the expected value as (category size + 3)/2. Adjusted naming scores were computed as (mean rank – expected value)/(expected value – 1).

This index has some desirable properties. It takes on values between –1 (if a brand was named first by all participants) and +1 (if a brand was not named by any participants). A value of 0 is obtained if the mean rank observed for a category member is equal to the expected rank value. The effect of this adjustment is to eliminate the correlation with category size.

Across the 48 items, the correlation between the adjusted naming scores[2] and the latency scores was .62 ($p < .001$). Category items that were named early in a listing were also identified as members of the category relatively quickly. Conversely, category members that came to mind later, if at all, required more deliberation when they were the object of questions about category membership. Thus, the two measures that involve a conscious analysis of category membership correlated highly with one another.

However, both of these measures also correlated with the facilitation measure. The correlation was .44 for the naming scores and .41 for the latency scores (both $ps < .005$). Thus, greater facilitation was associated with earlier rankings among members of that category and faster latencies of response to an inquiry about category membership.[3]

Discussion

The findings suggest that all three of the measures of associative strength used here provide a valid means of determining what specific items are strongly associated with a given category. On the assumption that a researcher's major

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[2] The correlation between the raw naming scores (unadjusted for category size) and the latency scores was .45 ($p < .005$). The correlation with the facilitation scores was .39 ($p < .01$).

[3] The naming ($r = .41$, $p < .005$) and latency scores ($r = .35$, $p < .02$) also correlated with the facilitation difference scores. However, these correlations were slightly lower in magnitude than those obtained for the more methodologically justifiable ratio measure of facilitation.

concern when examining associative strength is with the likelihood that a given item will be spontaneously activated from memory, the facilitation measure is obviously the best. This measure is the most direct indicant of whether a given item receives some activation in memory when the category is considered. It is the only one of the three measures in which respondents' conscious goals and deliberate retrieval strategies exert a minimal role. Respondents are not presented with a direct query that calls their attention to a specific potential association, as in the latency measure. Nor are they assigned a specific task goal of retrieving category items, as is the case for the naming measure. On these grounds, it must be the measure of choice.

Unfortunately, the facilitation measure is not at all practical or feasible for use in a survey context. However, it does provide a yardstick by which the validity of the naming and latency measures can be judged. The findings indicate that the naming and latency measures each provide a reasonable estimate of the likelihood that a given item will be activated from memory automatically upon presentation of the product category label. They each show a solid correlation to the most direct measure of automatic activation: facilitation. Thus, the data support the use of naming and latency measures as indirect approximations of what is directly assessed by the facilitation measure, that is, the likelihood of automatic activation of a given item when the individual is not intentionally attempting to retrieve category membership information from memory. In this way, our findings serve to validate the naming and latency measures, both of which are fairly easy to use in a survey context.

Obviously, the present data are limited to just one domain of associative strength, that between a given category (i.e., a set of objects) and members of the category. Although more varied research is necessary before definitive conclusions can be drawn, the relations we observed here may hold true for other types of associations. As we noted earlier, beliefs are object-attribute associations. The object is equivalent to a category and the attribute to an item within the category. An attitude is a particular kind of object-attribute association, one in which the attribute of interest is the evaluation. Similarly, the self can be viewed as a category and self-attributes as members of the category. In all these cases, we would expect the relatively economical naming and latency measures to provide reasonably valid estimates of associative strength and to serve as useful proxies for the likelihood that a given "item" will be activated from memory automatically when a given "category" is presented.

The utility of such measures of associative strength is well illustrated by previous work. As reviewed earlier, many investigations have found latency data to be useful when attempting to predict behavior from attitudinal reports. Attitude-behavior consistency is generally greater among those respondents with more accessible attitudes (i.e., those who responded relatively quickly to the attitudinal query).

Similar utility has now been observed in domains other than attitudes, that is, domains involving associations other than object-evaluation ones. Huckfeldt, Levine, Morgan, and Sprague (1999) recently used response latency to examine the accessibility of self-identifications. The speed with which respondents could

answer a question about their political partisanship and a question about their political ideology (conservative vs. liberal) was noted. Partisanship and ideology were more predictive of various other survey responses among those individuals who responded relatively quickly to the self-identification questions. For example, partisanship related to the evaluations of each of a number of specific politicians (e.g., Clinton, Gore, Gingrich). Ideology related to respondents' overall level of support for government spending across a variety of areas (e.g., the arts, education, scientific research, medical care, ecology) as well as to opinions regarding a set of ideologically relevant issues (e.g., death penalty, school prayer, abortion, equal rights for women). In each of these cases, the relation was significantly stronger among those respondents who had offered their self-identifications relatively quickly.

Latency of response to category membership also has proven useful as a dependent measure. Fazio, Herr, and Powell (1992) used a category membership measure, much like the one used here, to examine the effectiveness of television commercials promoting brand names previously unfamiliar to viewers. Of particular interest were commercials that used what the investigators referred to as a "mystery" strategy; these ads did not reveal the identity of the brand being promoted until the end of the ad. When tested later, participants exposed to such mystery ads identified the advertised brands as members of a given product category more quickly than did participants exposed to versions of the same ads edited in such a way that the brands were identified early in the ad. Thus, mystery ads were found to be more effective in building associations in memory between the product category and the novel brand name. Apparently, by raising viewers' curiosity about the identity of the brand that is being advertised, mystery ads lead viewers to be especially ready to categorize the brand when it is finally revealed. Such goal- directed processing appears to promote the development of stronger category-brand associations in memory.

The naming measure also has proven useful in both experimental and survey research. Early output during a listing task has been used as a means of identifying trait constructs that are chronically accessible for an individual. Such research has demonstrated that ambiguous information about a target person is more likely to be interpreted in terms of the chronically accessible trait than in terms of less accessible traits (e.g., Bargh et al., 1988). In addition, information that is relevant to the chronically accessible construct is more likely to influence impressions of the target person and to be recalled than information that is relevant to a less accessible trait (e.g., Higgins et al., 1982).

The strength of category-item associations as indexed by order of output also has been found to influence decision-making. Posavac, Sanbonmatsu, and Fazio (1997) arranged a situation in which research participants selected a charity to receive what would have been their payment for having participated, were it not for a departmental policy that prohibited such payment when students were earning extra course credit. Charity selection was found to vary as a function of whether

the participants were or were not provided with a list of charities to consider. Some participants selected a recipient from a list of alternatives, whereas others were simply asked to name a charity to which they would like to donate. When the decision alternatives were specified, participants tended to select a charity that they had reported preferring strongly in an earlier session. However, participants for whom the decision alternatives were left unspecified (i.e., those who had to generate potential recipients themselves) were less likely to exhibit such correspondence with their attitudes. An additional experiment revealed that participants in the unspecified-alternatives condition were more likely to donate money to a charity that they had named relatively early when asked to list examples of charitable organizations in a presumably unrelated, earlier experiment. Thus, decisions were influenced by the accessibility of specific charities, which did not necessarily correspond to individuals' stated preferences when asked about the complete list of charities. A charity that was strongly endorsed when individuals were forced to consider their evaluation of it did not necessarily come to mind when they needed to generate a potential recipient for themselves, and hence did not necessarily receive consideration as a possible recipient. In sum, when individuals had to generate the alternatives themselves, their donation decisions were affected relatively more by the strength of association between the general category "charities" and the specific charitable organizations. In comparison, individuals supplied with the potential alternatives made their decisions relatively more on the basis of their evaluative preferences.

Recent work by Huckfeldt, Levine, Morgan, and Sprague (1998) provides an excellent example of the use of *both* a naming task and response latency in actual survey research. Respondents were asked to name up to five people with whom they discuss government, elections, and politics. Later in the interview, they were asked to identify the presidential candidate supported by each of the discussants they had named. The latency with which these responses were made was noted. The order in which discussants were named was related to the latency with which the discussants' voting preferences could be identified. That is, the earlier a discussant had been named, the easier it was for the respondent to indicate the discussant's voting preferences. Interestingly, this relation was itself moderated by a time variable: the week in which the interview occurred. The relation dissipated over the course of the election campaign. The preferences of even the later-named discussants could be identified relatively more rapidly if the interview had been conducted toward the end of the campaign. As the authors noted, this effect of time suggests that the campaign promoted discussions about politics and voting preferences even within the respondents' more peripheral relationships.

This review indicates that measures of associative strength can be useful methodological tools for social, political, and marketing psychologists. Many of the constructs in which such researchers are interested can be fruitfully viewed as category-item associations in memory. Consideration of the strength of such associations and their resulting accessibility from memory can enhance our predictive and

explanatory power. By establishing the validity of two relatively easy-to-use measures of associative strength, it is our hope that the present findings will further encourage both theoretical consideration of the role of accessibility and empirical work examining its influence.

ACKNOWLEDGMENTS

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