

Prototypicality norms for 28 semantic categories

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The extent to which an item is a prototypical exemplar of a category has been found to predict several experimental results (e.g., reaction times in category classification, free and cued recall of lists, release from proactive inhibition in recall). We present prototypicality ratings for 840 words, equally distributed over 28 categories. The categories were taken from Battig and Montague's (1969) normative tables; only those categories that contained "concrete" items in common usage were employed in the study. Intragroup reliability correlations were high for all categories tested, as were the correlations for prototypicality ratings between the present study and that of Rosch (1975). In addition, correlations between prototypicality ratings, production frequencies, and word frequencies of the items are given.

Rosch (1975) has provided support for the theoretical and empirical utility of prototypes. Prototypes, according to Rosch, are abstract cognitive representations of concepts. In her 1975 study, Rosch collected norms on 10 categories (bird, tool, fruit, furniture, sport, vegetable, toy, vehicle, clothing, and weapon). In that study, it was shown that subjects regard the task of rating exemplars (instances) of a category in terms of prototypicality (i.e., goodness of example) as a reasonable one and that they are also quite reliable in their prototypicality ratings. These findings were replicated by Rosch and Mervis (1975), even though the stimulus materials were changed from words to pictures of the exemplars. In a categorization task, Rosch (1975) found reaction time differences between words that are high in prototypicality and words that are low in prototypicality (i.e., atypical words). Specifically, when subjects are required to determine whether or not two words belong to the same category, shorter reaction times are generated for prototypical pairs than for atypical pairs if the subjects are primed with the category label. Subjects also have been found to produce prototypical items before atypical ones even when frequency of experience with the items is controlled (Rosch, 1975). Kellar and Kellas (1978) found differences in the encoding of (proto)typical vs. atypical items. They showed that a shift in level of (proto)typicality produced a significant release from proactive inhibition, whereas a shift in level of production frequency did not. However, it was suggested that both (proto)typicality and production frequency reflected category structure, since high-frequency items were

also retained better than low-frequency ones in two out of three categories tested.

Since the prototypicality of an exemplar consistently predicts a number of phenomena, an updated extension of Rosch's (1975) normative study appeared to be of interest. Prototypes have already shown themselves to be useful descriptive tools, and an increase in the number of categories for which prototypicality ratings are obtained would undoubtedly allow the ratings to be used in lexical decision, word perception, and memory experiments whose designs require a larger number of categories. The present study was designed to gather new prototypicality ratings for a more extensive list of (28) categories.

METHOD

Stimuli

The criterion employed in choosing the categories for which ratings of instances were gathered was very similar to that of Rosch (1975). Each of the 56 categories of Battig and Montague's (1969) normative tables was rated for concreteness by 14 independent judges. A category was considered to be concrete if all the items contained in it were concrete nouns. The items were considered to be concrete nouns (in accordance with Rosch's procedure) only if they could be unequivocally represented by pictures. In order to insure that the categories contained items in common usage, categories were eliminated if they did not contain at least five items that had a frequency of 10 or more per million words in the Kučera and Francis (1967) sample of written English. Unlike the Rosch (1975) procedure, however, categories were not eliminated on the basis of part-whole relationships (e.g., a part of a building, a part of the human body) in order to increase the pool of categories available for use.

Thus, 28 categories (rated as concrete by at least 10 of the 14 judges) were selected. In addition to the 10 categories included in the Rosch (1975) norms, the following 18 categories were included: color, country, animal, cloth, money, kitchen utensil, clergy, metal, instrument, earth formation, beverage, building part, human body part, state, tree, dwelling, reading material, and weather. In the prototypicality rating experiment,

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for each of the 28 categories, the first 30 items listed in the Battig and Montague (1969) normative study were used.

Subjects

Subjects were 50 male and 50 female undergraduate students enrolled in introductory psychology courses at the University of California at San Diego. All students were native speakers of English and participated for course credit.

Procedure

Due to time constraints, each subject rated 14 of 28 randomly selected categories. Each subject rated all 30 instances from each of the 14 categories s/he was given. Thus, a total of 50 subjects rated each of the 28 categories. Each list of 30 items was typed on a separate page and headed by the category label. The order of instances in any given category was randomized. Subjects were asked to rate on a 7-point scale how good an example of the category each instance was. A rating of "1" corresponded to the instance's being a very good example or fit of the category; a rating of "7" indicated that the instance was considered to be a very poor example. The other numbers of the 7-point scale indicated intermediate judgments.

Specific instructions were similar to those of Rosch (1975), with the exception that subjects were given an additional analogy for clarification purposes. Subjects were told that another way to deal with the task was to imagine that they were trying to teach a child the concept of "a dog." Obviously, some dogs are better examples of the category, in that one would

want to point them out to the child in order to get across to her/him the idea or concept of what a dog is. Thus, subjects were told that if they were given the specific instance of "German shepherd" and they thought that a German shepherd was a good example to point to as a dog, then "German shepherd" should be given a low numerical rating. If, on the other hand, they would not use a "Pekingese" as a good example for the child, then "Pekingese" should be given a high numerical rating. As in the Rosch (1975) instructions, subjects were specifically told that the judgments had nothing to do with how well they liked the specific instances they were rating.

RESULTS AND DISCUSSION

Table 1 contains the mean prototypicality scores and standard deviations for each word in the 28 categories. Within each category, the words are arranged in order of decreasing prototypicality. Thus, the first word is the exemplar rated as most prototypical and the last word is the exemplar rated as most atypical. Each "mean score" is the mean of the prototypicality ratings obtained from our subjects for a particular exemplar in a category. These scores have a possible range of "1" (which corresponds to prototypical) to "7" (which corresponds to atypical).

Table 1
Prototypicality (Goodness-of-Example) Ratings for 28 Semantic Categories

Member	Goodness of Example		Member	Goodness of Example		Member	Goodness of Example	
	Mean	SD		Mean	SD		Mean	SD
An Article of Clothing								
pants	1.20	.78	t-shirt	2.38	1.29	vest	3.68	1.65
shirt	1.36	1.03	shoes	2.42	1.55	slip	3.70	1.85
dress	1.58	1.20	shorts	2.44	1.26	stockings	3.80	1.76
trousers	1.62	1.18	sweater	2.50	1.23	tie	4.14	1.75
blouse	1.86	1.34	socks	2.60	1.39	belt	4.22	1.72
slacks	1.86	1.25	suit	2.66	1.66	nylons	4.34	1.76
skirt	1.92	1.24	underpants	2.74	1.58	scarf	4.42	1.69
coat	2.12	1.29	undershirt	3.18	1.83	hat	4.42	1.85
jacket	2.20	1.28	bra	3.26	1.75	girdle	4.42	1.96
underwear	2.30	1.50	overcoat	3.46	1.72	gloves	4.72	1.70
An Article of Furniture								
chair	1.24	.59	chest	2.50	1.59	divan	3.64	2.11
table	1.26	.69	bureau	2.64	1.61	footstool	3.70	1.58
couch	1.32	1.11	bookcase	2.76	1.52	piano	3.98	1.68
sofa	1.48	1.34	cabinet	2.80	1.51	hifi	4.06	1.67
end table	1.80	1.07	lamp	2.98	1.63	stereo	4.32	1.73
coffee table	1.80	1.36	lounge	3.20	1.71	hassock	4.38	1.81
desk	1.96	1.37	davenport	3.26	2.16	television	4.60	1.88
bed	2.04	1.43	stool	3.32	1.70	rug	4.60	2.03
dresser	2.08	1.26	bench	3.38	1.70	radio	5.30	1.76
love seat	2.16	1.71	buffet	3.50	1.92	picture	5.32	1.52
A Bird								
dove	2.04	1.29	parakeet	2.82	1.56	owl	3.40	1.85
bluejay	2.14	1.46	parrot	2.84	1.68	hummingbird	3.40	1.92
robin	2.16	1.39	jay	2.86	1.76	swallow	3.44	1.91
sparrow	2.16	1.42	seagull	2.88	1.76	oriole	3.56	1.59
pigeon	2.36	1.72	cardinal	2.90	1.68	duck	3.94	2.06
bluebird	2.38	1.54	woodpecker	3.06	1.63	thrush	4.20	2.08
blackbird	2.52	1.58	wren	3.18	1.73	starling	4.20	1.81
eagle	2.56	1.67	hawk	3.20	1.77	chicken	4.32	2.06
crow	2.70	1.66	redbird	3.30	1.80	pheasant	4.62	1.94
canary	2.72	1.67	falcon	3.32	1.57	vulture	4.74	1.87

Table 1 Continued

A Carpenter's Tool								
saw	1.28	1.03	sander	3.06	1.60	pencil	3.72	2.35
hammer	1.52	1.23	plane	3.10	1.88	square	4.20	1.93
screwdriver	1.98	1.44	screws	3.14	1.93	awl	4.30	1.83
nails	1.98	1.77	vise	3.14	1.73	wedge	4.34	1.56
drill	2.22	1.53	lathe	3.36	2.01	wrench	4.40	1.86
level	2.38	1.44	pliers	3.42	1.64	knife	4.54	1.97
saw horse	2.46	1.69	t-square	3.50	1.72	axe	4.74	1.78
sandpaper	2.70	1.54	tri square	3.56	1.69	plumb line	4.92	1.74
wood	2.72	2.42	chisel	3.64	1.64	crow bar	5.32	1.74
ruler	2.76	1.65	file	3.70	1.78	plumb	5.50	1.40
A Color								
red	1.38	1.10	turquoise	2.96	1.54	burgundy	3.60	1.64
blue	1.38	1.23	gold	3.20	1.70	black	3.64	2.24
yellow	1.44	1.18	scarlet	3.30	1.75	white	3.66	2.40
green	1.58	1.03	rose	3.44	1.49	maroon	3.72	1.59
orange	1.80	1.18	lavender	3.46	1.63	tan	3.84	1.87
purple	2.06	1.19	aqua	3.48	1.69	navy	3.90	1.85
violet	2.64	1.41	silver	3.52	2.02	magenta	3.92	1.84
pink	2.70	1.45	beige	3.52	2.02	chartreuse	4.02	2.04
blue-green	2.80	1.36	indigo	3.56	1.88	olive	4.36	1.70
brown	2.94	1.80	gray	3.58	2.12	mauve	4.64	1.87
A Country								
United States	1.36	1.21	Russia	2.20	1.71	Argentina	2.96	1.70
France	1.80	1.41	China	2.30	1.67	Ireland	3.06	1.53
England	1.94	1.42	Sweden	2.32	1.58	Scotland	3.08	1.59
Italy	1.94	1.48	America	2.56	2.08	India	3.10	1.98
Japan	1.98	1.42	Brazil	2.64	1.57	Israel	3.12	1.85
Germany	2.02	1.57	Norway	2.70	1.69	Greece	3.24	2.05
Spain	2.02	1.36	Denmark	2.72	1.40	Belgium	3.28	1.71
Switzerland	2.12	1.35	Australia	2.74	1.94	Cuba	3.42	2.04
Mexico	2.14	1.54	Poland	2.84	1.75	Vietnam	3.80	2.06
Canada	2.14	1.88	Austria	2.94	1.72	Africa	4.84	2.67
A Four-Footed Animal								
dog	1.50	1.15	goat	2.68	1.27	camel	3.66	1.72
cat	1.66	1.21	sheep	2.72	1.37	moose	3.80	1.81
horse	1.94	1.39	fox	2.78	1.57	giraffe	4.10	1.94
cow	2.30	1.53	zebra	2.86	1.46	rhinoceros	4.12	1.69
wolf	2.36	1.32	mule	2.94	1.58	rabbit	4.26	1.82
lion	2.44	1.46	antelope	3.16	1.62	mouse	4.36	1.90
tiger	2.46	1.39	bull	3.20	1.56	bear	4.38	1.92
deer	2.56	1.33	buffalo	3.32	1.65	squirrel	4.42	1.96
donkey	2.62	1.29	elephant	3.34	1.92	hippopotamos	4.44	1.85
leopard	2.68	1.63	pig	3.38	1.66	rat	4.56	1.81
A Fruit								
orange	1.14	.73	tangerine	2.44	1.54	watermelon	3.12	1.59
apple	1.18	.66	plum	2.46	1.54	lime	3.24	1.80
pear	1.64	.92	apricot	2.46	1.58	mango	3.74	2.01
banana	1.70	1.34	lemon	2.58	1.69	raisin	4.22	1.85
peach	1.86	1.34	pineapple	2.60	1.47	prunes	4.28	1.85
strawberry	2.02	1.38	blueberry	2.62	1.54	fig	4.32	1.80
cherry	2.02	1.39	raspberry	2.78	1.75	pomegranate	4.72	1.81
grape	2.10	1.11	melon	2.80	1.56	coconut	4.78	1.66
grapefruit	2.26	1.24	cantaloupe	2.88	1.72	avocado	5.28	1.86
nectarine	2.32	1.50	berry	2.96	1.82	tomato	5.28	1.80
A Kind of Cloth								
cotton	1.46	1.16	velvet	2.80	1.54	burlap	4.34	2.07
wool	1.86	1.16	muslin	3.46	1.84	seersucker	4.36	1.82
silk	1.86	1.23	tweed	3.50	1.62	broadcloth	4.40	2.05
terry cloth	2.14	1.58	chiffon	3.80	1.60	crepe	4.48	1.74
linen	2.28	1.64	dacron	3.86	1.81	mohair	4.64	1.59
flannel	2.34	1.41	cheesecloth	3.88	1.93	jersey	4.70	1.85
nylon	2.60	1.56	canvas	4.14	1.91	taffeta	4.80	1.73
corduroy	2.64	1.70	rayon	4.16	1.83	brocade	4.94	1.80
denim	2.70	1.69	orlon	4.24	1.91	madras	5.46	1.66
satin	2.72	1.46	acrilan	4.34	1.80	acetate	5.52	1.54

Table 1 Continued

A Kind of Money								
dollar bill	1.34	.77	francs	2.54	1.82	centavo	3.08	1.86
dollars	1.50	.84	shilling	2.56	1.82	pence	3.26	2.10
dimes	1.80	1.07	pesos	2.62	1.88	pounds	3.30	2.01
pennies	1.82	1.30	cents	2.68	1.85	ruble	3.32	2.18
quarters	1.90	1.11	ten dollars	2.76	1.74	gold	3.50	2.04
nickels	1.90	1.37	yen	2.80	2.00	silver	4.08	2.09
half-dollar	2.24	1.22	mark	2.92	2.03	check	4.28	2.11
fifty-cent piece	2.32	1.39	lira	3.00	2.02	bill	4.46	2.32
silver dollar	2.32	1.45	paper money	3.04	2.18	bonds	4.82	2.03
coins	2.44	1.53	gold piece	3.08	1.87	five	4.86	2.10
A Kitchen Utensil								
knife	1.78	1.18	ladle	2.80	1.41	cup	3.40	1.75
spoon	1.98	1.41	mixer	2.80	1.60	dish	3.42	1.77
fork	2.06	1.39	rolling pin	3.00	1.78	toaster	3.48	1.58
measuring cup	2.08	1.28	plate	3.02	1.62	glass	3.86	1.64
measuring spoons	2.14	1.36	egg beater	3.04	1.83	saucer	4.02	1.60
pot	2.18	1.22	beater	3.08	1.66	pot holder	4.10	1.95
spatula	2.24	1.36	can opener	3.10	1.69	oven	4.16	2.04
pan	2.36	1.26	bowl	3.18	1.44	stove	4.36	2.08
frying pan	2.60	1.18	blender	3.22	1.64	refrigerator	4.48	2.06
skillet	2.66	1.41	strainer	3.34	1.98	sink	4.80	1.78
A Member of the Clergy								
priest	1.52	1.13	preacher	3.08	1.83	brother	4.60	1.83
minister	1.76	1.06	monk	3.10	1.81	deaconess	4.84	1.74
reverend	1.80	1.16	rabbi	3.10	2.06	monsignor	4.84	2.08
clergyman	2.00	1.65	chaplain	3.18	1.55	evangelist	5.30	1.53
bishop	2.44	1.64	cardinal	3.22	1.93	abbot	5.36	1.63
pope	2.44	1.98	sister	3.36	1.88	subdeacon	5.42	1.58
pastor	2.60	1.67	deacon	3.76	1.89	elder	5.58	1.34
father	2.64	2.03	parson	4.00	1.82	rector	5.60	1.64
nun	2.64	1.69	friar	4.02	1.82	cantor	5.76	1.52
archbishop	2.68	1.52	missionary	4.42	1.60	doctor	6.32	1.42
A Metal								
iron	1.24	.74	lead	2.12	1.44	lithium	4.58	1.95
steel	1.32	.94	platinum	3.02	1.62	manganese	4.62	1.59
tin	1.50	.81	zinc	3.04	1.48	mercury	4.64	1.79
aluminum	1.52	.97	chromium	3.30	2.02	cobalt	5.04	1.77
copper	1.60	.99	tungsten	3.52	2.20	beryllium	5.08	1.94
brass	1.72	1.18	ore	3.60	1.93	cadmium	5.24	1.72
silver	1.84	1.18	alloy	3.90	2.04	rubidium	5.26	1.91
gold	1.92	1.23	uranium	4.00	1.92	potassium	5.34	1.55
bronze	1.94	1.25	magnesium	4.28	1.85	sodium	5.82	1.37
nickel	1.96	1.44	titanium	4.56	1.97	calcium	5.98	1.42
A Musical Instrument								
piano	1.48	1.30	drum	2.74	2.04	bass	3.54	1.68
guitar	1.54	1.20	fiddle	2.88	1.35	viola	3.54	1.82
flute	1.68	1.08	horn	2.90	1.71	harpsichord	3.56	1.77
trumpet	1.82	1.06	tuba	2.94	1.52	bassoon	3.68	1.81
violin	2.02	1.36	french horn	3.00	1.50	bass fiddle	3.76	1.85
saxophone	2.22	1.37	cello	3.02	1.63	accordion	3.84	1.73
trombone	2.40	1.28	harp	3.14	1.73	oboe	4.00	2.03
clarinet	2.42	1.37	bugle	3.34	1.78	cymbals	4.08	1.71
organ	2.46	1.49	piccolo	3.44	1.86	cornet	4.24	1.76
banjo	2.66	1.36	harmonica	3.48	1.69	xylophone	4.32	1.88
A Natural Earth Formation								
Grand Canyon	1.60	1.23	river	2.92	1.78	desert	3.24	1.88
mountain	1.84	1.53	gorge	3.00	1.70	lake	3.26	2.03
volcano	2.08	1.50	cliff	3.04	1.34	crevice	3.28	1.64
island	2.22	1.34	cavern	3.06	1.67	rock	3.32	1.82
valley	2.36	1.68	ocean	3.10	2.28	crater	3.54	2.12
cave	2.56	1.53	stone	3.14	1.77	hill	3.62	1.48
canyon	2.64	1.51	sea	3.14	2.14	ravine	3.64	1.59
glacier	2.70	1.58	ridge	3.16	1.61	gully	3.72	1.58
stream	2.72	1.62	plain	3.16	1.74	stalactite	3.74	2.26
creek	2.84	1.74	plateau	3.16	1.56	stalagmite	3.84	2.27

Table 1 Continued

A Nonalcoholic Beverage								
milk	1.78	1.56	pepsi	2.66	1.57	tomato juice	2.96	1.70
water	1.80	1.80	cocoa	2.66	1.73	sprite	3.00	1.54
lemonade	2.02	1.45	coke	2.68	1.56	limeade	3.00	1.59
iced tea	2.02	1.33	fruit juice	2.70	1.56	orange drink	3.04	1.47
soft drink	2.30	1.57	seven-up	2.72	1.59	root beer	3.10	1.71
tea	2.34	1.61	koolaid	2.76	1.67	mountain dew	3.16	1.48
apple juice	2.38	1.54	pop	2.80	1.76	soda	3.22	1.68
coffee	2.50	1.81	orangeade	2.84	1.30	ginger ale	3.34	1.91
grape juice	2.60	1.37	juice	2.90	1.69	punch	3.60	1.68
shake	2.66	1.71	grapefruit juice	2.90	1.61	teem	3.94	2.11
A Part of a Building								
roof	1.98	1.72	hall	2.98	1.44	beams	3.98	1.66
door	2.00	1.54	foundation	3.00	2.05	glass	4.14	1.81
wall	2.32	1.53	bathroom	3.02	2.00	side	4.26	2.14
room	2.38	1.48	chimney	3.16	1.86	cornerstone	4.28	2.09
floor	2.52	1.59	kitchen	3.56	2.06	elevator	4.30	1.88
ceiling	2.64	1.61	steps	3.60	1.32	office	4.32	2.06
basement	2.72	1.73	attic	3.62	1.93	corner	4.32	2.02
stairway	2.84	1.45	stair	3.64	1.44	brick	4.46	1.62
window	2.94	1.74	lights	3.72	1.69	cement	4.74	1.78
cellar	2.98	1.74	closet	3.88	1.75	wood	5.20	1.68
A Part of the Human Body								
head	1.64	1.22	heart	2.36	1.83	shoulders	2.94	1.48
legs	1.66	1.08	face	2.54	1.73	elbow	2.96	1.86
hand	1.66	1.26	knee	2.54	1.50	ankle	3.16	1.68
foot	1.76	1.25	toe	2.56	1.77	tooth	3.44	2.00
arms	1.76	1.29	stomach	2.58	1.73	lungs	3.46	2.00
eye	1.88	1.41	back	2.76	1.60	throat	3.60	1.62
ear	2.10	1.39	neck	2.84	1.69	hair	3.66	1.97
nose	2.12	1.55	tongue	2.90	1.74	liver	3.88	2.13
mouth	2.34	1.27	brain	2.90	2.00	nail	4.28	2.11
finger	2.34	1.62	chest	2.92	1.54	trunk	4.36	1.99
A Sport								
basketball	1.28	.99	rugby	2.40	1.54	wrestling	3.68	1.79
baseball	1.40	1.21	handball	2.44	1.47	ice skating	3.78	1.62
football	1.48	1.25	skiing	2.50	1.52	boxing	3.78	1.92
tennis	1.72	1.20	gymnastics	2.86	1.63	horseback riding	3.88	1.79
soccer	1.74	1.07	polo	2.88	1.71	ping pong	3.98	1.78
volleyball	1.78	1.13	waterskiing	2.88	1.60	fencing	4.04	1.68
softball	2.02	1.36	badminton	3.12	1.45	bowling	4.12	1.78
hockey	2.16	1.57	racing	3.56	1.75	archery	4.46	1.53
track	2.18	1.38	lacrosse	3.60	2.11	fishing	4.48	1.75
swimming	2.30	1.33	golf	3.62	2.03	hunting	4.98	1.61
A State								
California	1.34	1.02	Ohio	3.12	1.67	Maine	3.62	1.79
Texas	2.30	1.46	Massachusetts	3.18	1.73	Indiana	3.62	1.70
New York	2.36	2.00	Michigan	3.22	1.56	North Carolina	3.68	1.61
Florida	2.38	1.24	Maryland	3.30	1.57	Mississippi	3.68	1.75
Colorado	2.64	1.64	Alaska	3.34	2.13	Georgia	3.70	1.91
Oregon	2.72	1.43	Vermont	3.50	1.79	Alabama	3.78	1.83
Pennsylvania	2.82	1.47	New Hampshire	3.52	1.76	Iowa	3.94	1.98
Washington	2.86	1.74	New Jersey	3.52	1.67	Wisconsin	4.06	1.81
Hawaii	2.90	1.88	Illinois	3.54	1.72	New Mexico	4.14	2.04
Virginia	2.94	1.54	South Carolina	3.60	1.70	Delaware	4.28	1.97
A Toy								
doll	1.46	.86	marbles	2.46	1.31	bat	3.82	1.62
yo-yo	1.72	.95	rocking horse	2.60	1.55	balloon	3.84	1.49
rattle	1.78	1.15	wagon	2.72	1.59	bike	3.96	1.73
doll house	1.84	.98	jump rope	3.00	1.48	bicycle	4.00	1.82
ball	1.88	1.12	truck	3.10	1.97	car	4.02	2.02
jacks	1.96	1.31	tricycle	3.10	1.49	soldiers	4.32	1.85
top	2.04	1.41	train	3.46	2.02	game	4.40	1.76
teddy bear	2.12	1.22	puzzle	3.64	1.60	rope	5.10	1.75
stuffed animal	2.18	1.27	plane	3.70	2.02	gun	5.48	2.04
block	2.42	1.30	boat	3.80	2.09	horse	5.52	1.73

Table 1 Continued

A Tree								
oak	1.68	1.28	spruce	2.80	1.76	ash	3.44	1.75
pine	1.80	1.54	apple	2.90	1.67	pear	3.46	1.67
redwood	1.84	1.49	weeping willow	2.98	1.81	plum	3.60	1.68
fir	2.04	1.52	sycamore	3.00	1.75	chestnut	3.62	1.77
evergreen	2.30	1.81	cherry	3.16	1.77	hickory	3.72	1.96
birch	2.32	1.41	palm	3.22	2.03	poplar	4.38	2.00
maple	2.38	1.47	peach	3.22	1.71	dogwood	4.40	2.03
elm	2.38	1.61	beech	3.30	1.78	magnolia	4.44	2.03
walnut	2.74	1.83	orange	3.36	1.76	locust	5.34	1.79
cedar	2.76	1.68	willow	3.38	1.78	tulip	6.00	1.71
A Type of Human Dwelling								
house	1.12	.52	dorm	3.30	1.64	split-level	4.48	2.06
apartment	2.00	1.21	houseboat	3.74	1.80	motel	4.66	1.83
home	2.08	2.00	hut	3.88	1.61	shack	4.80	1.64
cottage	2.16	1.18	igloo	4.02	2.20	tent	4.82	1.64
cabin	2.22	1.18	building	4.04	2.22	hotel	4.84	1.65
ranch house	2.64	1.50	trailer	4.08	1.50	adobe	4.92	1.90
farmhouse	2.72	1.59	room	4.12	1.97	boat	5.16	1.89
log cabin	3.00	1.58	castle	4.12	2.18	tree house	5.18	1.71
duplex	3.16	1.50	bungalow	4.24	1.74	cave	5.48	1.79
mansion	3.20	1.82	teepee	4.46	1.86	lean-to	5.50	1.78
A Type of Reading Material								
book	1.44	1.15	periodical	3.02	1.71	comic book	3.88	1.87
novel	1.48	1.03	poem	3.04	1.48	bulletin	3.98	1.72
newspaper	1.60	1.12	nonfiction	3.04	1.97	encyclopedia	4.02	1.80
short story	2.00	1.12	letter	3.10	1.80	pamphlet	4.10	1.64
paperback	2.28	1.62	essay	3.20	1.48	brochure	4.10	1.97
magazine	2.36	1.54	poetry	3.22	1.61	leaflet	4.12	1.66
text book	2.44	1.72	journal	3.26	1.63	note	4.14	1.84
biography	2.44	1.43	Bible	3.32	1.80	paper	4.38	2.16
fiction	2.76	2.05	booklet	3.50	1.62	poster	5.20	1.76
article	2.88	1.39	play	3.68	1.98	dictionary	5.30	1.92
A Vehicle								
car	1.12	.85	bicycle	2.98	1.60	subway	4.26	1.76
auto	1.22	.82	train	3.06	1.88	trolley	4.28	1.67
truck	1.78	1.09	bike	3.12	1.55	helicopter	4.30	1.91
bus	1.84	1.25	airplane	3.26	2.01	wagon	4.36	1.90
cab	2.12	1.38	motorscooter	3.32	1.58	trailer	4.36	1.75
motorcycle	2.20	1.40	jet	3.46	1.91	tricycle	4.42	1.98
jeep	2.24	1.49	boat	3.68	1.89	carriage	4.54	1.97
taxi	2.32	1.50	ship	3.84	1.96	cart	4.60	1.70
motorbike	2.74	1.40	tractor	3.94	1.98	tank	4.96	1.92
streetcar	2.86	1.78	scooter	3.96	1.62	skates	5.90	1.52
A Vegetable								
carrot	1.60	1.31	lima beans	2.50	1.47	squash	3.28	1.77
green beans	1.68	1.19	bean	2.60	1.56	beets	3.28	1.53
spinach	1.84	1.27	cucumber	2.70	1.84	onions	3.36	1.91
string beans	1.86	1.21	radishes	2.84	1.50	peppers	3.74	1.51
pea	1.92	1.16	cabbage	2.94	1.68	parsley	3.86	1.70
broccoli	2.04	1.29	brussels sprouts	2.94	1.66	eggplant	3.90	1.74
corn	2.16	1.39	potato	3.06	1.86	greens	3.94	2.16
lettuce	2.16	1.73	cauliflower	3.10	1.69	turnip	4.06	1.96
celery	2.38	1.44	green peppers	3.26	1.50	kale	4.92	1.93
asparagus	2.44	1.55	tomato	3.28	2.30	rice	5.34	1.98
A Weapon								
pistol	1.40	1.12	bomb	3.00	1.77	whip	4.38	1.65
gun	1.40	1.05	bow and arrow	3.10	1.75	chain	4.52	1.67
rifle	1.44	1.09	bazooka	3.18	2.19	stick	4.82	1.61
machine gun	1.60	1.39	tank	3.20	2.06	rock	4.90	1.66
knife	1.86	1.43	club	3.24	1.51	poison	4.94	1.68
sword	2.38	1.64	brass knuckles	3.24	1.85	stone	5.18	1.66
hand grenade	2.68	1.72	cannon	3.36	1.97	rope	5.26	1.54
spear	2.70	1.72	arrow	3.48	1.75	hand	5.26	1.86
missile	2.72	2.00	fists	4.06	1.73	hammer	5.86	1.47
bayonet	2.90	1.90	ax	4.06	1.92	automobile	6.18	1.35

Table 1 Continued

A Weather Phenomenon								
thunderstorm	1.72	1.21	thunder	2.54	1.58	drought	3.38	2.01
tornado	1.94	1.57	fog	2.84	1.95	cold	3.82	1.97
storm	1.96	1.62	hail	2.84	1.91	sunny	3.90	2.02
hurricane	2.02	1.42	windstorm	2.84	1.80	humidity	4.10	1.68
typhoon	2.04	1.54	rainbow	2.86	1.78	sun	4.26	2.17
rain	2.08	1.70	lightning	2.92	1.78	ice	4.26	1.97
snow	2.34	1.75	wind	3.02	1.89	heat	4.32	1.77
hailstorm	2.44	1.68	sleet	3.04	1.93	tidal wave	4.38	2.18
cyclone	2.48	1.79	monsoon	3.10	2.26	hot	4.56	1.88
blizzard	2.48	1.94	clouds	3.30	1.84	earthquake	5.30	2.39

Note—In the experiment, the entries presented in this table were typed in uppercase letters.

In order to obtain a measure of reliability, subjects were randomly split into two groups, and both a split-half Pearson *r* (in which the mean prototypicality ratings of half of the subjects are correlated with the other half) and a split-half Spearman *r* (in which the rank orderings of half of the subjects are correlated with the other half) were computed (results are shown in Table 2). The rank orderings were computed on the basis of the mean prototypicality scores; thus, the most prototypical exemplar was given a rank of “1” and the most atypical exemplar was given a rank of “30.” Tie scores were given equal ranks. Replicating Rosch (1975), we found that the prototypicality ratings (i.e., goodness-of-example ratings) were quite reliable. The mean split-half Pearson *r* for the 28 categories was .980, with a standard deviation of .032, and the mean split-half Spearman *r* for the 28 categories was .895, with a standard deviation of .078. The mean split-half Spearman *r* is slightly lower than the mean split-half Pearson *r* due to the fact that a small difference in prototypicality ratings often is translated into a somewhat larger difference in rank orderings. Although this difference in reliability is relatively small, it is consistent for all 28 categories.

Since 10 of the 28 categories tested were the same as those that Rosch (1975) used in her study, both a Pearson *r* (on mean prototypicality ratings) and a Spearman *r* (on rank orderings) were conducted to get a second measure of reliability (Table 3). The mean Pearson *r* comparing Rosch’s prototypicality ratings with those of the present study was .887, with a standard deviation of .072. The mean Spearman *r* comparing the rank orderings of the two studies was .867, with a standard deviation of .094. Thus, there appears to be considerable overlap and reliability in the ratings, despite regional and temporal differences between the two studies.

In order to address the possibility that prototypicality ratings may be equivalent to production frequency ratings (Battig & Montague, 1969) or to word frequency ratings (Kučera & Francis, 1967), Spearman correlations for each category were computed (Table 4). In order to equate the range of prototype rank orderings and of word frequencies, the raw word frequencies were converted into rank orderings for each category. For production frequency ratings, the ranks provided by the

Table 2
Split-Half Reliability Correlations

Category	Split-Half Pearson <i>r</i>	Split-Half Spearman <i>r</i>
Clothing	.989	.968
Furniture	.984	.942
Bird	.983	.784
Tool	.982	.885
Color	.980	.815
Country	.986	.872
Animal	.986	.925
Fruit	.989	.951
Cloth	.982	.909
Money	.979	.887
Kitchen Utensil	.977	.912
Clergy	.990	.959
Metal	.998	.958
Instrument	.989	.952
Earth Formation	.961	.752
Beverage	.942	.649
Building Part	.980	.927
Human Body Part	.978	.900
Sport	.988	.938
State	.977	.875
Toy	.995	.886
Tree	.966	.853
Dwelling	.981	.953
Reading Material	.986	.905
Vehicle	.982	.909
Vegetable	.969	.924
Weapon	.976	.948
Weather	.978	.921

Note—Split-half Pearson *r* = mean prototypicality scores; split-half Spearman *r* = prototypicality rank orderings.

Table 3
Interstudy Reliability Correlations

Category	Pearson <i>r</i>	Spearman <i>r</i>
Clothing	.939	.951
Furniture	.921	.938
Bird	.713	.657
Tool	.834	.852
Fruit	.926	.921
Sport	.855	.894
Toy	.884	.800
Vehicle	.928	.904
Vegetable	.856	.796
Weapon	.952	.960

Note—Pearson *r* = mean prototypicality scores; Spearman *r* = prototypicality rank orderings.

Table 4
Spearman Correlations Among Three Measures

Category	N	Spearman r		
		1	2	3
Clothing	27	.484	.005	.497
Furniture	25	.587	.197	.429
Bird	25	.601	-.047	.113
Tool	22	.630	.133	.194
Color	28	.604	.377	.621
Country	28	.869	.374	.391
Animal	27	.469	.282	.638
Fruit	26	.742	.007	.158
Cloth	17	.547	.311	.414
Money	18	.587	-.459	-.397
Kitchen Utensil	18	.521	-.042	.249
Clergy	27	.760	.187	.374
Metal	26	.806	.688	.808
Instrument	19	.751	.556	.407
Earth Formation	27	.138	.125	.539
Beverage	14	.260	.545	.593
Building Part	30	.635	.225	.083
Human Body Part	30	.814	.664	.479
Sport	22	.515	.289	.011
State	24	.330	.290	.307
Toy	22	.064	-.246	.422
Tree	28	.644	.270	-.032
Dwelling	26	.175	.342	.285
Reading Material	28	.394	.141	.404
Vehicle	25	.494	.368	.561
Vegetable	22	.687	.286	.277
Weapon	25	.632	.003	.049
Weather	26	.548	-.383	.058

Note—N = number of items (out of 30); 1 = production frequency vs. prototypicality, 2 = word frequency vs. prototypicality, 3 = production frequency vs. word frequency.

Battig and Montague (1969) study were used. The mean Spearman r for production frequency vs. prototypicality was .546, with a standard deviation of .205, the mean Spearman r for word frequency vs. prototypicality was .199, with a standard deviation of .275, and the mean Spearman r for production frequency vs. word frequency was .319, with a standard deviation of .254. Notice that all three Spearman correlations tend to be moderate to small and that the variances in all three are rather large.

The largest of the three correlations was the correlation between production frequency and prototypicality (.546), which is reasonable since existing evidence (Kellar & Kellas, 1978) indicates that these two factors are extremely difficult to tease apart. Intuitively, it seems that the exemplars that subjects are most exposed to tend to be the ones that they produce and that exposure may also influence to some degree how good an example of a category an item is considered to be. However, note that in all 28 categories, the correlation between production frequency and prototypicality is always smaller than the split-half reliability correlation.

As far as word frequencies are concerned, there are a number of serious objections to their use in these

analyses: (1) Many of the words in the list are two-word items (e.g., dollar bill, United States, measuring cup, etc.). The Kučera and Francis (1967) norms include only single or, at most, hyphenated words, and there is no valid way to combine the frequencies for different words. (2) There was some question as to what to do with plurals. For the present study, the following strategy was adopted: If a word lost the intended category meaning as it changed from the singular case to the plural or vice versa, only the case that contained the intended meaning was used; otherwise, the singular and plural frequency counts were combined. The following examples illustrate the rule: Under the "clothing" category, "pants" loses its intended meaning in its singular form (pant), and therefore, only the frequency count from "pants" is used. Under the "color" category, "green" and "greens" both retain the intended meaning, and therefore, the frequency counts from both words are combined. Under the "vegetable" category, "greens" loses its intended meaning in its singular form (green), and therefore, only the frequency count from "greens" is used. (3) Another problem with word frequency is that many items have more than one meaning (e.g., orange = a tree, a fruit, a color; gold = a color, a type of money, a metal). Because the Kučera and Francis (1967) norms do not take semantics into account, there is no way to discriminate what proportion of the frequencies can be attributed to the different meanings.

Note that the third objection listed may be one reason why the word frequency correlations are so low (.199, .319). It is possible that exemplars (items) that are atypical have multiple (perhaps even primary) meanings that are not related to the specific category in which the exemplar is classified. If this is true, then the atypical (i.e., low-prototype) exemplars may actually have a high word frequency count, and the result would be the low, even negative, correlations observed.

In summary, prototypicality norms for 28 semantic categories of 30 items apiece were collected. Results showed that both intersubject and interstudy reliability were very high. Prototypicality ratings were not highly correlated with word frequency norms; however, there was a moderate correlation between prototypicality ratings and production frequency norms. Thus, caution is advised when one interprets results from studies using prototypical items, as these also tend to be the items that are high in production frequency. If at all possible, sets of words should be used with one of the two factors (either prototypicality or production frequency) held constant while the other is systematically varied.

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