

A SET OF 400 PICTURES STANDARDISED FOR PORTUGUESE

Norms for name agreement, familiarity and visual complexity for children and adults

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ABSTRACT - The present article provides normative measures for 400 pictured objects (Cycowicz et al., 1997) viewed by Portuguese speaking Brazilian University students and 5-7 year-old children. Name agreement, familiarity and visual complexity ratings were obtained. These variables have been shown to be important for the selection of adequate stimuli for cognitive studies. Children's name agreement was lower than that of adults. The children also failed to provide adequate modal names for 103 concepts, rated drawings as less familiar and less complex, and chose shorter names for pictures. The differences in ratings between adults and children were higher than those observed in the literature employing smaller picture sets. The pattern of correlations among measures observed in the present study was consistent with previous reports, supporting the usefulness of the 400 picture set as a tool for cognitive research in different cultures and ages.

KEY WORDS: picture, naming, familiarity, visual complexity, children, adults.

Conjunto de 400 figuras padronizadas para o português: normas de nomeação, familiaridade e complexidade visual para crianças e adultos

RESUMO - Este artigo fornece dados normativos para o Brasil de um conjunto de 400 figuras de objetos (Cycowicz et al., 1997) avaliados por estudantes universitários e crianças de 5-7 anos. Foram obtidos dados referentes à consistência de nomeação, familiaridade com os objetos representados e complexidade visual dos desenhos. Existem evidências de que essas variáveis são importantes para a adequada seleção de estímulos para estudos cognitivos. A consistência de nomeação das crianças foi menor que a dos adultos. Em relação aos adultos, as crianças não conseguiram nomear adequadamente 103 conceitos, avaliaram os desenhos como sendo menos familiares e menos complexos e escolheram nomes mais curtos para as figuras. As diferenças nas avaliações entre adultos e crianças foram mais altas que as observadas na literatura que envolveu conjuntos menores de desenhos. O padrão de correlações entre medidas observadas no presente trabalho são consistentes com relatos anteriores, o que dá suporte à utilidade desse conjunto de 400 figuras como ferramenta para pesquisas cognitivas em diferentes culturas e faixas etárias.

PALAVRAS-CHAVE: figura, nomeação, familiaridade, complexidade visual, crianças, adultos.

Naming objects is a fundamental ability that humans use to communicate through language. The apparent simplicity of naming belies the complexity of its underlying cognitive processes^{1,2}. Investigations of the underlying cognitive processes involved in naming therefore require that studies be conducted under carefully controlled conditions that have often included the use of pictured objects as laboratory analogues of object themselves. However, no normative data for such stimuli was available until

the end of the 1970s, precluding adequate comparisons between studies that employed heterogeneous drawings. A turning point in this line of study was the publication of Snodgrass & Vanderwart's³ standardisation of 260 pictures of common objects drawn in black over a white background. These stimuli were selected according to variables considered important for memory processes and were drawn so as to follow pre-determined rules that permit evaluation of consistency between them, such

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as size of drawings (see ⁴), number of details and orientation³.

Among the most important aspects of picture naming are name agreement, or the rate at which objects depicted in the drawings are referred to with the same name, familiarity with the concepts and visual complexity of the drawings. These measures are essentially independent and may be assumed to affect different stages during picture processing⁵. Name agreement is a robust predictor of naming difficulty and is important for studies of naming latency, picture-name matching, recall, recognition and investigations in which verbal coding is manipulated⁶. Familiarity is an important predictor of picture naming latencies (the more familiar the concepts, the shorter the naming time), while visual complexity affects variables such as naming latency, tachistoscopic recognition threshold and memorability⁶.

Since the pioneering paper of Snodgrass & Vanderwart³ in the USA, similar work has been conducted on the 260 picture-set for British⁷, Spanish⁸, Japanese⁹ and Icelandic populations. A preliminary adaptation into Portuguese was also accomplished with a smaller (150) set of pictures¹¹. A larger set of 400 pictures has been studied more recently for both North Americans⁵ and Frenchmen⁶. Normative data for different languages show that despite pictures being judged to be of similar familiarity and visual complexity, name agreement is specific to the particular language investigated⁹. Hence, normative data must be obtained for every language under which research employing drawings are conducted. In addition to the importance of considering the native tongue of the subjects used in studies of picture naming, the age of participants must also be taken into consideration. Most of the normative data cited above was obtained solely for university students (>18 years of age, hereafter referred to as adults). Exceptions are the studies by Berman et al.¹² and Cycowicz et al.⁵, who employed 7 to 10, and 5 to 7 year-olds, respectively. Norms for the younger children were found to be different from those of both older children and adults, suggesting that they exhibit immature lexical and/or semantic networks⁵. Normative data in other languages must therefore also include subjects of different ages in order to assure that age-appropriate pictorial stimuli are available. There is an obvious advantage at obtaining norms for small children because the concepts that they can name correctly are useful for all other ages and can be used in developmental studies. Norms for young adults are also essential in all languages because university students constitute the most

widely used population in studies of cognitive psychology.

The present study aimed at obtaining normative data on the 400 picture-set proposed by Cycowicz et al.⁵ to be used in Portuguese speaking populations from Brazil. Subjects were middle-class university students and 5 to 7 year-olds children. Name agreement, picture familiarity, visual complexity and length of modal names were studied, closely following Cycowicz et al.'s⁵ methods.

METHOD

Subjects

All middle-class, native Portuguese speakers who lived in the city of São Paulo, Brazil. Their social-economic status was determined by the ABIPEME scale, developed by the "Brazilian Association of the Institute of Market Research".

a. Adults: 150 university students (24 men), aged 23.6 ± 6.9 years (mean \pm SD).

b. Children: thirty-six children (18 boys), 5 to 7 year-olds (83.9 ± 7.4 months; range 73-95 months), who had normal behaviour as assessed using the CATRS-10¹³.

Stimuli

Four-hundred pictures of common objects drawn in black over white background⁵. These picture originated from different sources [picture-set 1 containing 260 drawings³; picture-set 2 containing 61 drawings¹²; picture-set 3 with 79 stylistically similar drawings to the ones in the first 2 sets but obtained elsewhere⁵]. The pictures were randomly divided into 5 lists of 80 pictures. The order of presentation of these lists was balanced across subjects and sessions.

Procedure

Essentially the same as employed by Cycowicz et al.⁵, except that only naming, familiarity and complexity were determined. The ethics committee approved the protocol. Informed assent and consent forms were obtained from the adult participants, the children and their parents.

a. Children: were tested individually, in 5 sessions, at the school they attended. For name agreement the children were asked "What is this picture?" To obtain scores for familiarity the question was "How often do you think about this thing?". A lot (scored 5), sometimes (scored 3), or very little (scored 1)? After giving the answer, complexity scores were obtained by asking subjects "How difficult is it to draw this picture? Is it hard (scored 5), medium (scored 3) or easy (scored 1)?" When the children did not recognise an object depicted they were asked "What can you do with it?" or "Where do you find it?", in order to determine whether they knew the concept and were only failing to come up with its name. If the child answered either of these questions his naming was con-

sidered DKN ("doesn't know name") and familiarity and complexity ratings were obtained. If the child failed to answer the questions concerning the nature of the object, naming was scored as DKO ("doesn't know object") and the next picture was presented. Practice pictures were shown at the beginning of each session. To illustrate the familiarity ratings, pictures of an ice-cream (very familiar) and a light house (not at all familiar) were employed. For the scores on complexity, a triangle (not complex) and a computer (complex) were used as examples. In order to reduce response bias, the subjects were encouraged not to rate all pictures using the same points in the familiarity and complexity scale, but to use the whole range of responses possible. The children gave their responses aloud and the experimenter entered the information into response sheets.

b. Adults: subjects were run in groups (16 to 45 individuals) in 5 sessions separated by 5 minute intervals. The 400 pictures were projected sequentially for 10 seconds each on a white surface using a slide projector. Subjects were instructed to use answer sheets that were given them to enter the name of the objects that were depicted on the slides. They were specifically told not to worry about spelling. If they were unable to name the drawing, they were instructed to put down "don't know the name" (DKN) or "don't know the object" (DKO). Familiarity with the concept and visual complexity of pictures were also scored using 5 point scales (1 represented the least familiar and complex) and subjects were instructed to try to use the full range of scoring points. Adult participants received the same instructions and practice pictures as the children. We chose to instruct children and adults to use a different number of points for the ratings of familiarity and visual complexity [children (1, 3 and 5) and adults (1 to 5)] because Cykowicz et al.⁵ cite that a pilot study showed that children do not assign ratings across the full range of numerical values used by adults.

Measures

The following measures were obtained for each picture:

a. Modal name: the name given by the majority of subjects. Spelling mistakes were corrected. When the children's modal names were different from that of the adults' they were classified by 2 judges into one of 5 categories: synonym (including local substitutes such as the South American feline "onça" for leopard), superordinates (such as bug for ant), subordinate (apple tree for tree), coordinates (same category, such as cockroach for beetle), component (part of names, such as ball for football), or failures (including definitions of objects, such as "to make things", and similar objects, such as clock for compass). Discrepancies between judges were resolved by a third judge.

b. Name agreement: refers to the degree to which subjects agree on the name of the picture. Two measures were used: the percentage of subjects who used

the modal name and the H index, calculated in the following manner:

$$H = \sum_{i=1}^k P_i \log_2(1/P_i)$$

This index takes into account the number of subjects that gives each one of the different names used for the same picture^{3,5}. k refers to the number of different names given to each picture, and the Pi is the proportion of subjects who gave each name. DKN and DKO do not enter into the computation of this index. The greater the naming agreement between subjects, the closer the H is to 0.

c. Familiarity: refers to the familiarity of the concept depicted. Scores ranged from 1 to 5 (1=very unfamiliar, 2=unfamiliar, 3=medium, 4=familiar, 5=very familiar).

d. Visual complexity: refers to the amount of lines and details in the drawing. Scores ranged from 1 to 5 (1=least complex; 5= most complex).

e. Length of modal name: number of letters in the modal name. In some cases, more than one modal name was available, so the mean length was calculated.

Word frequency is not available in Portuguese so it was not included in this study. Naming latency was not assessed because adult subjects were not evaluated individually. We chose not to assess image consistency because it would make rating sessions far too long for both children and adults. Also, because age of acquisition was not assessed in children, we opted to exclude this measure from the evaluation of adults.

Statistical analysis

Involved pictures as units of measure. The hypothesis of normality and equality of variance of scores of adult and children on the 7 measures investigated (percentage of subjects who used the modal name, the H statistics, familiarity, visual complexity, word length, DKN and DKO) for the whole 400 picture-set were tested using Kolmogorov-Smirnov and Levene tests, respectively. Most measures did not show normal distribution or homocedasticity so non parametric tests were employed. Spearman rho correlations between the seven measures were carried out for data of adults and children separately. Spearman r correlations of scores of each variable between children and adults were also obtained. Scores of children and adults were compared using Mann-Whitney U test. The level of significance used was 0.01 because of the large number of comparisons conducted. Parametric tests (Pearson correlations and Student t tests) were also used in order to enable comparisons with previous reports on the picture-sets [Pearson correlations and two-tailed Student t tests for independent samples were also conducted to analyse all results obtained here. The pattern of effects was unchanged (data not shown except for correlations between data of adults and children; see Table 4)].

RESULTS

Table 1 contains the following indices for the whole 400 picture-set for both age groups: H index

Table 1. Summary statistics for adults and children for the 400 picture set.

	Name agreement (H)		Name agreement (%)		Familiarity		Complexity		DKN		DKO		Length	
	adults	children	adults	children	adults	children	adults	children	adults	children	adults	children	adults	children
Mean	0.79	1.13	0.77	0.60	4.00	3.38	2.65	2.42	0.04	0.08	0.03	0.10	6.99	6.45
SD	0.73	0.79	0.25	0.30	0.65	0.77	0.76	0.50	0.09	0.11	0.08	0.15	3.15	2.81
N	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Median	0.58	1.11	0.88	0.63	4.09	3.44	2.58	2.38	0.07	0.03	0.00	0.03	6.00	6.00
Minimum	0.00	0.00	0.00	0.00	2.33	1.71	1.17	1.31	0.00	0.00	0.00	0.00	2.00	2.00
Maximum	3.60	3.48	1.00	1.00	5.00	4.88	4.20	3.75	0.73	0.81	0.55	0.75	25.00	20.00
IQR	1.08	1.27	0.35	0.55	1.10	1.25	1.26	0.75	0.05	0.13	0.01	0.13	3.00	2.00
Q1	0.18	0.44	0.62	0.35	3.49	2.75	2.04	2.06	0.00	0.00	0.00	0.00	5.00	5.00
Q3	1.26	1.71	0.97	0.91	4.59	4.00	3.30	2.81	0.05	0.13	0.01	0.13	8.00	7.00
Skewness	0.97	0.25	-1.08	-0.25	-0.48	-0.17	0.11	0.32	3.33	2.16	3.43	1.94	1.82	1.81
Kurtosis	0.32	-0.75	0.06	-1.26	-0.69	-1.02	-1.05	-0.66	14.94	6.23	12.48	3.45	4.38	4.13

H, information statistics; %, percentage of name agreement; IQR, interquartile range; Q1 and Q3, 25th and 75th percentiles, respectively; DKN, doesn't know name; DKO, doesn't know object; Length, number of letters of the modal name. Means of adults (n=150) and children (n=36) in all parameters differed (see text).

(name agreement), percentage of subjects producing the modal name, familiarity, visual complexity, name length, DKN and DKO.

Information on each of the 400 pictures for both age groups [H index (name agreement), percentage of subjects producing the modal name, familiarity, visual complexity, name length, DKN and DKO] and all alternative names given can be found at <http://www.epm.br/psico/PSICO.HTM>.

The correlation analysis conducted to determine the degree of relationship between measures for adults and children can be found in Tables 2 and 3, respectively. Table 4 shows the correlations and comparisons of the 7 measures between adults and children.

The Mann-Whitney U tests between measures from the different age groups showed that the children's percentage of name agreement was lower than adults', while the H index and use of DKO ($p < 0.001$) and DKN ($p < 0.01$) were lower for adults. The children also rated pictures as less familiar and less complex ($p < 0.001$) and used shorter names for pictures ($p < 0.01$).

Two concepts had no modal name for the adults (two names were used for each concept with the same frequency). The modal names given by the adults to 24 of the pictures were not correct translations of the intended names in English (see [http://](http://www.epm.br/psico/PSICO.HTM)

www.epm.br/psico/PSICO.HTM). These misnomers were separated into 3 groups:

a. Ambiguous pictures: 56 (chisel, misinterpreted as a screwdriver), 262 (basin, misinterpreted as a bath), 298 (paddle, as a racket), 299 (parachute, as a balloon), 334 (callipers, considered tweezers), and 340 (cymbals, a spool of thread).

b. Intended names in English that can be translated into Portuguese but that were nevertheless named with common local substitutes: pictures 136 (leopard), 159 (ostrich), 364 (lizard) and 394 (vulture) were misinterpreted as common animals of the Brazilian fauna ("onça, ema, lagartixa, urubu", respectively). Picture 261 (acorn) was mistaken for a walnut, picture 297 (net) was named with the word "rede" rather than "puçá" (the specific, albeit relatively unknown name for this concept in Portuguese), drawing 330 (blowfish) was named fish, and picture 386 (squash) was mistaken for a typical South American vegetable ("chuchu"). Similar names of clothes were used for pictures 125 (jacket) and 224 (sweater). Picture 141 (lips) was described as a mouth, while picture 149 (mouse) was considered a rat. Also, picture 99 (French horn) was mistaken for a trombone and picture 243 (trumpet) for a cornet. Picture 283 (fishing reel) was also considered a spool of thread. Picture 345 (easel) was mistaken for a blackboard. Finally, the 2 pictures that received no

Table 2. Spearman's rho correlations among the measures obtained from adults (see note of table 1; * $p < 0.01$).

	H	%	Familiarity	Complexity	Length	DKN	DKO
H		-0.967*	-0.474*	0.269*	0.160*	0.583*	0.513*
%			0.558*	-0.312*	-0.185*	-0.656*	-0.595*
Familiarity				-0.643*	-0.123	-0.732*	-0.565*
Complexity					0.159*	0.390*	0.242*
Length						0.162*	0.113
DKN							0.684*
DKO							

Table 3. Spearman's rho correlations among the measures obtained from children (see note of table 1; * $p < 0.01$).

	H	%	Familiarity	Complexity	Length	DKN	DKO
H		-0.836*	-0.389*	0.278*	0.027	0.429*	0.526*
%			0.590*	-0.407*	-0.122	-0.681*	-0.768*
Familiarity				-0.600*	-0.201*	-0.614*	-0.650*
Complexity					0.195*	0.356*	0.369*
Length						0.236*	0.143*
DKN							0.676*
DKO							

Table 4. Comparison of scores of each measure between adults and children using parametric and non-parametric analysis (i.e. Pearson/Spearman correlations and Student t tests/Mann-Whitney U test; * $p < 0.01$; ** $p < 0.001$).

	Pearson correlation	Spearman rho correlation	Student t Test	Mann-Whitney U test
H	0.563*	0.627*	-6.34**	-6.12**
%	0.585*	0.670*	8.42**	-7.51**
Familiarity	0.835*	0.855*	48.17**	-11.250**
Complexity	0.849*	0.852*	23.48**	-4.15**
Length	0.628*	0.628*	2.57*	-2.68*
DKN	0.476*	0.685*	-4.47**	-2.59*
DKO	0.610*	0.648*	-7.67**	-7.00**

modal name could also be included in this category: picture 183 (raccoon) was named with the same frequency as a skunk and fox ("gambá" and "raposa") and picture 271 (closet) as "closet" and "armário" (cupboard).

c. Words that do not exist in Portuguese: picture 144 (mitten, considered a glove), picture 373 (pretzel, thought of as a biscuit).

Children provided 103 modal names that differed from those of adults and failed to determine a modal name for an extra 20 concepts (see <http://www.epm.br/psico/PSICO.HTM>). Synonyms, components and superordinate mistakes were observed 14 times each. Coordinate misnomers were the most frequent (28 concepts), while only one concepts was classified as a subordinate. The judges disagreed only on 5 of these classifications.

DISCUSSION

The distribution of H values for the adults has a low mean and is positively skewed, indicating that concepts have a high name agreement overall. The H of the children was larger, showing that name agreement is not as high as adults'. These results are in accord with Cykowicz et al.'s⁵ data for North American speaking subjects of the same age groups.

The fact that among the 400 pictures only 24 did not reflect the exact translation of the intended names in English by adults in the present study indicates that the majority of the pictures from Cykowicz et al.⁵ represent concepts that are known by Brazilian university students. Among the differences in naming, 16 reflected use of common local substitutes, although all but 2 had H values higher than the 75th percentile (Q3, see Table 1), suggesting that these concepts had little naming consistency. The exceptions were pictures 141 (lips) and 149 (mouse), which were consistently named as mouth ('boca') and rat ("rato"), respectively. While mouth and lips are certainly adequate descriptions of picture 141, the word for mouse in Portuguese, "camundongo", possibly because it is so long, is often substituted for "rato" (rat). Pictures 144 (mitten) and 373 (pretzel) do not exist in Portuguese and should therefore be avoided in studies in this language. Our data further suggests that pictures 56 (chisel), 262 (basin), 298 (paddle), 299 (parachute), 334 (callipers), and 340 (cymbals), should not be employed in any language as they proved ambiguous concepts and were named as different objects entirely. Alario & Ferrand⁶, who conducted a study of the 400 pictures using French adults, replaced 7 pictures (no. 19, 95, 96, 283, 288, 327, 373) because they had been selected in the "American context". In the present study, only 2 of these pictures (no. 96 and 327) had H scores below the 75% percentile, suggesting that they might in fact be inadequate for other cultures.

Children named 103 concepts differently from adults and failed to determine a modal name for 30 pictures. Considering the type of misnomers employed by children when compared to adults, we found that most were coordinate mistakes, which appeared twice as often as synonyms, components, and superordinates, indicating that children tend to error by confusing object in the same semantic category. Only 30 of the 103 differences in naming were failures, and in most cases the names attributed to the pictures resembled the object depicted (e.g. clock for compass). Overall, data on differences in naming by adults and children are in agreement with

results obtained for the same age groups by Cykowicz et al.⁵, who found that North American children named 90 concepts differently from adults, that these differences were most coordinate mistakes, and that naming failures did not appear to reflect perceptual or functional differences among age groups, but rather a lack of knowledge of particular concepts by the young children. For a more detailed discussion on the comparison of Brazilian and North American children see Miranda et al. (submitted)¹⁴.

The correlation analysis conducted to determine the degree of relationship between measures for adults and children separately (Tables 2 and 3) showed that the 2 measures of name agreement (H and %) were highly negatively correlated although correlations were much smaller when naming was compared between the age groups. Naming has been shown not to correlate as highly as familiarity and visual complexity⁸ when data obtained in different languages⁸ and ages¹² are contrasted. This was confirmed by our results in terms of the comparison between adults and young children. The names attributed to pictures may also differ among subjects who speak the same native language but who inhabit distinct regions or countries, are from different social and educational background, of different ages, and possibly genders. Hence, pilot studies with the specific population to be investigated must always be conducted so as to determine the adequacy of the norms for each language.

The following findings of correlations of relative magnitude suggest that concepts which were difficult to name are little known by the two age groups: the percentage of name agreement and familiarity were negatively correlated with DKN and DKO, the H index was positively correlated to DKN and DKO, and percentage of name agreement was correlated positively with familiarity. Familiarity was also negatively correlated with visual complexity for adults and children, suggesting that subjects find less complex figures more familiar as discussed by Snodgrass & Vanderwart³ and Berman et al.¹². The reason for this effect is unknown but it may be related to differences in the characteristics of the drawings, such as the number of details used to depict the objects¹². Ratings of DKN and DKO were positively correlated, indicating that the same pictures that were difficult to name were those of unclear concepts. Hence, because DKN and DKO ratings do not enter into the computation of the H statistics, pictures that receive a high number of these responses should be avoided

in cognitive studies in which name agreement must be high, even if their H index seems adequate.

The remaining correlations were small (<0.4) but with few exceptions were highly significant. Word length seems to represent an independent attribute of the pictures from the other measures investigated in the present study because it correlated little or not at all with them.

The correlations between measures of adults and children analysed separately were generally higher than those obtained from adults of different countries using smaller sets^{3,5-8,12}, and also than those observed in studies using all 400 pictures^{3,6}. The reason for this may be that we combined ratings on all 400 pictures in the same analysis [unlike Cycowicz et al.⁵, who divided them into 3 sets] and used the same subjects to rate naming, familiarity and visual complexity [unlike Alario & Ferrand⁶], thus lowering variance which increases correlations. Nevertheless, the consistency in the pattern of correlations among measures reported for different cultures and age groups is still maintained here, supporting the usefulness of the 400 picture-set as a tool for cognitive research.

When data of Brazilian children were compared to that of adults, the correlations were smaller than those observed by Berman et al.¹², who contrasted ratings of North American 7 to 10 year-olds and adults for the combined analysis of sets of 259 and 61 pictures. This difference in effects may be due to 4 factors, independently or in combination: a) older children may use ratings that are more similar to those of adults than 5 to 7 year-olds'; b) Berman et al.¹² seemed to have used parametric analysis that tend to lead to higher correlations between measures; c) the third picture-set of 79 pictures, added to the previous two sets to make up the 400 pictures used here, include concepts that are less familiar to young children, more difficult to identify and have lower frequency counts⁵, and therefore may decrease the intercorrelation between the measures obtained from young children and adults for the whole 400 picture-set; d) the fact that the University students in the present study consisted basically of females. It is not possible to determine in what way the use of few men could bias the results reported here for little is known about gender differences in naming, especially when speeded responses are not required. In fact, the studies on Snodgrass and Vanderwart's and Cycowicz's pictures did not

take gender into account when analysing the data (see^{3,5-8}) and Sanfeliu & Fernandez⁸ and Alario & Ferrand⁶ even failed to report the sex of their volunteers. Unfortunately the classes of Psychology students tested (the chosen course in the other publications of adult norms for the picture sets) had more female subjects. With the children, who were assessed individually, it was possible to select volunteers so as to include the same number of boys and girls.

The comparison between age groups using Mann-Whitney U tests showed differences among all measures albeit the significant correlations between children's and adults' data. Children's name agreement was lower and the use of DKN and DKO was higher than that of adults, showing that children produced more alternative names and had more difficulty naming concepts. In addition, the children rated pictures as less familiar and less complex than adults, possibly due to their tendency to show a smaller range and less variation in their ratings⁵. The children also chose shorter names for pictures, reflecting that the vocabulary of 5 to 7 year-olds consists of shorter words, possibly because they are acquired earliest and are better represented in their lexicon⁵. Taken together, these results are in line with data presented by Cycowicz et al.⁵, although in many cases their data showed only a trend of difference between young children and adults while ours reached highly significant effects. This is not surprising since we used all 400 pictures in the same analysis while Cycowicz et al.⁵ divided them into 3 sets, which could have enhanced variances as discussed above. This illustrates the importance of using larger amounts of pictures when different populations are to be compared.

We hope that the normative data presented here will be used as a guide for the selection of pictorial stimuli to be used in research in several fields¹¹. Investigators who intend to study semantic memory using pictured objects can find pictures organised into semantic categories in Cycowicz et al.'s⁵ paper. Those interested in repetition priming should consult Snodgrass & Corwin¹⁵ for the 150 pictures that present low to moderate complexity and sufficient area to enable the creation of distinctly different fragmented images.

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