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Russian norms for name agreement, image agreement for the colorized version of the Snodgrass and Vanderwart pictures and age of acquisition, conceptual familiarity, and imageability scores for modal object names

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Abstract The aim of the present study was to provide Russian normative data for the Snodgrass and Vanderwart (*Behavior Research Methods, Instruments, & Computers*, *28*, 516–536, 1980) colorized pictures (Rossion & Pourtois, *Perception*, *33*, 217–236, 2004). The pictures were standardized on name agreement, image agreement, conceptual familiarity, imageability, and age of acquisition. Objective word frequency and objective visual complexity measures are also provided for the most common names associated with the pictures. Comparative analyses between our results and the norms obtained in other, similar studies are reported. The Russian norms may be downloaded from the Psychonomic Society supplemental archive.

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In a seminal study in American English, Snodgrass and Vanderwart (1980) provided normative data on name agreement, image agreement, conceptual familiarity, and visual complexity for a set of 260 black-and-white drawings. The goal was to provide researchers with picture norms that could be used for the careful design of experiments on perception, memory, and language. This enterprise has proven to be a great success, because the set of pictures used by Snodgrass and Vanderwart has been normed in many different populations and language communities. The Snodgrass and Vanderwart pictures have been normed for (taken chronologically) Spanish (Sanfeliù & Fernandez, 1996), British English (Barry, Morrison, & Ellis, 1997), French (Alario & Ferrand, 1999), Icelandic (Pind, Jónsdóttir, Tryggvadóttir, & Jónsson, 2000), Italian (Nisi, Longoni, & Snodgrass, 2000), Japanese (Nishimoto, Miyawaki, Ueda, Une, & Takahashi, 2005), Chinese (Weekes, Shu, Hao, Liu, & Tan, 2007), and Modern Greek (Dimitropoulou, Duñabeitia, Blitsas, & Carreiras, 2009). The set of pictures has also been normed in children (Cycowicz, Friedman, Rothstein, & Snodgrass, 1997). Snodgrass and Vanderwart have encouraged research into the collection of norms for pictured stimuli. This has also helped in the design of studies investigating the factors influencing naming speed (e.g., Alario et al., 2004, for French speakers; Bonin, Chalard, Méot, & Fayol, 2002, in French; Cuetos, Ellis, & Alvarez, 1999, in Spanish; Pind & Tryggvadóttir, 2002, in Icelandic; Weekes et al., 2007, in Chinese; Snodgrass, & Yuditsky, 1996, in American English), as well as spoken naming accuracy in patients (e.g., Cuetos, Aguado, Izura, & Ellis, 2002). It is important to note that other picture and photograph databases have been constructed and normed (e.g., Bates et al., 2003; Bonin, Peereman, Malardier, Méot, & Chalard, 2003, for a set of 299 objects in French; Brodeur, Dionne-Dostie, Montreuil, & Lepage, 2010, for a set of 480 photographs of objects in English; Himmanen, Genteles, & Sailor, 2003, for 60 line drawings that make up the Boston Naming Test; Martein, 1995, for a set of 216 objects in Dutch; Salmon, McMullen, & Filliter, 2010, for a set of 320 black-and-white photographs of objects). Despite the large number of normative studies conducted using the Snodgrass and Vanderwart pictures, it is still important to collect additional language-specific norms (Sanfeliù & Fernandez, 1996), because norms collected in one language may not be suitable for use in another. As has been shown by Yoon et al. (2004), there are cultural differences on several measures relating to the pictures, the underlying concepts, or the picture names that have to be controlled for when designing experiments. For instance, in a comparison of Chinese and American norms for 260 line drawings from Snodgrass and Vanderwart, Yoon et al. found that, although name agreement was equivalent for a subset of pictures (22%, or 57 pictures), this was not the case for another group of pictures (11%, or 29 pictures). Furthermore, although a comparison of Japanese norms for name agreement, age of acquisition (AoA), and familiarity (Nishimoto et al., 2005) with those reported in previous studies conducted in American, Spanish, French, and Icelandic revealed relatively high correlations overall, these correlations were lower in the case of name agreement. Importantly, even within the same language spoken by individuals in different countries (e.g., French in Canada vs. France), there are differences on certain norms (Sirois, Kremin, & Cohen, 2006). Within the same country and language, there are also differences between groups of speakers. Indeed, Yoon et al. found significant differences in name agreement percentages between older and younger American adults. In some cases, norms collected for a set of stimuli at a given period of time within a given language and/or community may need to be updated. This is especially true for photographs of celebrities (Bonin, Perret, Méot, Ferrand, & Mermillod, 2008), because individuals who were famous at a particular time may become less so as time passes (or the reverse may occur). The same phenomenon may, however, also be observed in the case of objects, since some items that were very familiar in the past (e.g., a *tape recorder*) may no longer be so, while the opposite development may also occur (e.g., an *iPad*). Using multiple regression analyses and the same set of stimuli, Johnston, Dent, Humphreys, and Barry (2010) found that their new and more up-to-date ratings accounted for a larger amount of variance in naming times than did those taken from a previous study—namely, the Barry et al. (1997) study. It therefore seems important to make sure that the norms are kept up-to-date.

The original Snodgrass and Vanderwart (1980) pictures have been modified for use in different formats (silhouettes, rotated, degraded, etc.). Lloyd-Jones and Luckhurst (2002) presented objects from this set of pictures as line drawings or silhouettes and found a category difference between living and nonliving things, with the former being responded to more quickly than the latter. Moreover, the difference was more pronounced in object decision than in spoken naming. Outline versions of the Snodgrass and Vanderwart pictures have been created to investigate the perceptual factors influencing the identification of everyday objects (Panis, De Winter, Vandekerckhove, & Wagemans, 2008). Pictures of nonobjects have also been created from this set (Ankerstein, Varley, & Cowell, 2009; Barbarotto, Laiacona, Macci, & Capitani, 2002). Of particular relevance for the present study is the research conducted by Rossion and Pourtois (2004), in which they transformed the original Snodgrass and Vanderwart pictures in order to obtain gray-textured and colorized versions of them. In the present study, we used the *colorized version* of the Snodgrass and Vanderwart pictures to collect norms for Russian adults. Our goal was to obtain a normative database for pictorial material that would be useful for future research into memory or in the field of language production and comprehension in Russian adults. The reason for using this set of pictures, rather than the original set of black-and-white Snodgrass and Vanderwart pictures, was that they have been found to greatly improve the speed and accuracy of naming performance, as compared with the black-and-white drawings (Rossion & Pourtois, 2004). Both the black-and-white and the colorized versions of the Snodgrass and Vanderwart pictures developed by Rossion and Pourtois were used by Weekes et al. (2007) in a multiple regression picture-naming study in Chinese. For both versions of the pictures, the authors found that although name agreement, rated AoA, and conceptual familiarity were reliable determinants of naming speed, the influence of image agreement was clearly reduced with the colorized pictures. The reduced influence of image agreement in the naming of colorized pictures suggests that these images speed up the recognition process involved in picture naming (Therriault, Yaxley, & Zwaan, 2009). Finally, in the Dimitropoulou et al. (2009) study conducted in Modern Greek, the colorized version of the Snodgrass and Vanderwart pictures was also used to collect norms for name agreement, AoA, and visual complexity. It is therefore clear that the colorized pictures should be considered for use in norming studies even though only a few previous studies have made use of them. We predict that their use will increase (for recent use, see, e.g., K. R. Humphreys, Boyd, & Watter 2010; Izura et al., 2011).

The Russian language

Russian is the official language of the Russian Federation, and it was the official language of the Soviet Union (1922–

1991). Russian has been ranked as the fourth most influential language in the world (Weber, 1999). Indeed, estimates of the number of people who speak Russian as their first or second language vary from 285 million speakers according to Weber (1997) to 455 million according to Crystal (1997).

Russian is spoken in 16 countries (Weber, 1999): in Russia, as well as in the countries of the former Soviet Union and in emigrant communities around the world, notably in Germany, Israel, the United States, Canada, Australia, and Latin America. Russian is one of the six official languages of the United Nations. It continues to be one of the official languages of Kyrgyzstan and Belarus and is used for official purposes in Kazakhstan and Ukraine. Russian belongs to the Indo-European language family and is one of the three contemporary East Slavic languages. Russian is written using a modified version of the Cyrillic alphabet, which consists of 33 letters. The relationship between the alphabet and pronunciation in contemporary standard Russian is not phonemic. Both derivational and inflectional morphologies are extremely rich. Derivation occurs primarily by means of prefixation and suffixation. (Compound prefixes and suffixes are allowed in contemporary standard Russian.)

The present normative study

In the present study, we followed the procedures used in the Alario and Ferrand (1999) and the Bonin et al. (2003) studies to collect norms for name agreement, image agreement, conceptual familiarity, imageability, and AoA in Russian adults.

Name agreement corresponds to the degree of agreement among individuals on a specific name to be used to refer to a pictured object. The number of alternative names provided for a particular picture across participants is recorded and used to compute two measures—namely, the percentage of participants who provide the most common name (the %*NA*) and the *H* statistic (Shannon, 1949). *H* reflects the number of alternative names provided by the participants and is computed using the following formula:

$$h = \sum_{i=l}^{k} p_i \log_2\left(\frac{1}{p_i}\right)$$

where k refers to the number of different names the participants give to an image and p_i is the value for each name as a proportion of all the alternative names. (The three categories of naming failures— do not know object [DKO], do not know its name [DKN], and tip of the tongue [TOT]—are not taken into account when *H* values are computed.) A picture is given a score of 0 when it elicits the same name from every participant who provided a name for it, and increasing H values reflect increasing uncertainty about a picture name. Name agreement is a strong determinant of naming latencies, with pictures with a low agreement score taking longer to produce than pictures with a high agreement score (e.g., Barry et al., 1997; Bonin et al., 2002; Ellis & Morrison, 1998; Snodgrass & Yuditsky, 1996; Vitkovitch & Tyrrell, 1995). It has been suggested that the effect of name agreement on picture-naming speed occurs either at the level of lexical selection or at the comprehension level involved in spoken word production (Barry et al., 1997). If the former locus is correct, the competition between alternative names would be responsible for the increase in naming latencies, whereas in the latter case, this increase would be due to the competition between alternative percepts, or concepts, activated on the basis of perceptual analyses of the picture. Vitkovitch and Tyrrell found evidence for these two different loci of name agreement effects (see also Cheng, Schafer, & Akyürek, 2010, for further evidence obtained using event-related potentials).

Image agreement is the degree to which the mental images formed by participants in response to an object name match the object's appearance. High image agreement scores on objects are associated with shorter naming times than are low image agreement scores (Barry et al., 1997; Bonin et al., 2002). It is generally agreed that this variable indexes the access to structural representations involved in picture naming, which correspond to the canonical perceptual representations of objects (G. W. Humphreys, Riddoch, & Quinlan, 1988).

Conceptual familiarity refers to acquaintance with the concept represented by the picture and is defined as the degree to which people come in contact with or think about the depicted item in their everyday lives. This variable is assumed to index semantic code activation. This variable has been found to exert a reliable, but variable, effect on naming times in healthy adults (Ellis & Morrison, 1998; Jolicoeur, 1985). Hirsh and Funnell (1995) found that familiarity predicted the performance of patients suffering from progressive semantic dementia, as well as that of aphasics (Feyereisen, Van der Borght, & Seron, 1988). As in most normative studies, pictures of objects were presented, and the conceptual familiarity scores collected (e.g., Alario & Ferrand, 1999; Manoiloff, Artstein, Canavoso, Fernández, & Segui, 2010; Morrison, Chappell, & Ellis 1997; Rossion & Pourtois, 2004; Salmon et al., 2010; Sanfeliù & Fernandez, 1996; Snodgrass & Vanderwart, 1980). These measures could, in principle, be obtained from the modal names, since in certain studies conceptual familiarity scores have been used to investigate the involvement of semantic codes in visual word recognition (e.g., Bonin, Barry, Méot, & Chalard, 2004). However, this method of collecting conceptual familiarity norms is rarely found in normative studies involving objects.

When evaluating the visual complexity of pictures, participants have to take account of the number of lines and details in the drawing. For each picture, they indicate their rating of the degree of visual complexity with point scales; for example, the score 1 is given to a *visually simple* picture and 5 to a *visually very complex* one. Although visual complexity affects ease of recognition in tachistoscopic tasks (e.g., Hartje, Hannen, & Willmes, 1986), only a few studies have shown it to be a reliable predictor of naming times (Barry et al., 1997; Bonin et al., 2002; Cycowicz et al., 1997; Weekes et al., 2007; but see Ellis & Morrison, 1998). Székely and Bates (2000) have proposed other measures of visual complexity that do not rely on behavioral performance, such as (subjective) visual complexity ratings. They have used the size of the digitized picture file to define what they refer to as *objective visual complexity*. More precisely, they compared more than 30 different file types and degrees of compression for 520 object pictures and found that PDF, TIFF, and JPG formats could be used as valid indices of objective visual complexity. According to Székely and Bates, the use of objective visual complexity scores avoids the problem that subjective ratings of visual complexity can be confounded with subjective familiarity. Moreover, these objective measures of visual complexity have been found to be highly correlated with each other and, importantly, with subjective ratings of visual complexity. It is also important to note that they are not related to word frequency. We consequently decided to compute and report only objective visual complexity scores (the number of bytes in JPG format) for the colorized pictures.

AoA has been found to be an important determinant of performance in various lexical-processing tasks in different languages and populations (for reviews, see Johnston & Barry, 2006; Juhasz, 2005). AoA effects are stronger in object or in face naming than in word reading in alphabetic languages (e.g., Bonin et al., 2004; Brysbaert & Ghyselinck, 2006; and see Johnston & Barry, 2006, for a comprehensive review). However, the use of rated AoA to investigate age-limited learning effects in lexical processing has been criticized, because AoA should be considered as a behavioral outcome and not as a genuine independent variable (Bonin et al., 2004; Bonin, Méot, Mermillod, Ferrand, & Barry, 2009; Zevin & Seidenberg, 2002, 2004). Nevertheless, rated AoA is still used as a factor to investigate current issues in picture naming (e.g., Dent, Johnston, & Humphreys, 2008; Laganaro & Perret, 2011), and work is still being conducted to collect AoA norms for a long list of words (e.g., Cortese & Khanna, 2008; Ferrand et al., 2008). We also included objective frequency in our analyses, and these values are reported for the modal names provided for each object. Word frequency counts (per million words) were taken from the *New Frequency Dictionary of Russian Vocabulary* (Lyashevskaya & Sharov, 2008; available at http://dict.ruslang.ru/freq.php). This dictionary is based on a corpus of modern Russian incorporating over 150 million words. (In January 2008, the Russian National Corpus contained 52,392 texts consisting of 149,357,020 tokens.) The corpus is a reference system based on a collection of Russian texts provided in electronic form. The Russian National Corpus primarily covers the period from the middle of the 18th to the early 21st century. This period represents both the past and present Russian language in a wide range of sociolinguistic variants: literary, colloquial, vernacular, and, in part, dialectal. The corpus includes original (nontranslated) works of fiction (prose, drama, and poetry) of cultural importance. Apart from fiction, the corpus includes a large volume of other sources of written (and, for the later period, spoken) language: memoires, essays, journalistic works, scientific and popular scientific literature, public speeches, letters, diaries, documents, and so forth. Finally, we collected imageability scores for the modal names. Imageability corresponds to the ease with which a mental image can be generated in response to the presentation of a written word. Imageability is thought to index semantic richness and is often used to investigate the activation of semantic codes in lexical-processing tasks (e.g., Cortese, Simpson, & Woolsey, 1997; Cuetos & Barbon, 2006; Shibahara, Zorzi, Hill, Wydell, & Butterworth, 2003; Strain, Patterson, & Seidenberg, 1995, 2002). As is described below, we followed the same procedure as Paivio, Yuille, and Madigan (1968) to collect the norms for the picture names.

We start by describing the methodology used to collect the normative data. We then describe several analyses that were performed on the data. At the same time, analyses of the relations between the present data and previously published data for the same stimuli are reported.

Method

Participants

A total of 181 participants were involved in the rating tasks. There were 46 people in the name agreement task, 31 in the AoA rating task, 36 in the familiarity rating task, 34 in the image agreement task, and another 34 in the imageability task. The participants (80 males and 101 females; mean age, 37.5 years; range, 19–56 years) were all native speakers of Russian living in Saint Petersburg and had normal or corrected-to-normal vision. They were all studying for a university degree. All were volunteers and were not paid or given course credit for their participation. The different rating tasks were performed collectively, but any given participant was involved in only one type of task.

Materials

We used the 260 colorized images of the corresponding Snodgrass and Vanderwart (1980) drawings that were created by Rossion and Pourtois (2004). The entire set of colorized pictures is available for free download at http://www.nefy.ucl.ac.be/facecatlab/stimuli.htm. As was explained in the introduction, the colorized pictures have been normed by Dimitropoulou et al. (2009) in Modern Greek for name agreement, AoA, and visual complexity. Even though the colorized pictures have been used less frequently in norming studies than have the corresponding black-and-white drawings, they are worth considering, since they lead to more accurate and faster naming performances than do the black-and-white drawings.

Procedure

The rating tasks closely followed the procedures adopted by both Alario and Ferrand (1999) and Bonin et al. (2003), both in terms of the tasks performed and in the way these tasks were completed.

For the name agreement, image agreement, and conceptual familiarity tasks, the pictures were projected on a large white screen by means of an overhead projector. For each rating task, the set of pictures was presented in a different random order to the different groups of participants.

For the collection of the name agreement scores, the participants were told that they would see a picture and that they had to write down the first name (which could sometimes consist of more than one word) that came to mind on the answer sheet. When they could not provide the name of the picture, they were asked to indicate whether this was because they did not recognize the object (they had to write down DKO), they did not know its name (DKN), or they were in a TOT state.

Image agreement was measured by asking the participants to generate a mental image in response to a name and then to rate the correspondence between their image and a subsequently displayed picture. In the image agreement task, the modal name corresponding to the picture was spoken aloud by the experimenter prior to its presentation. This was followed by a 5-s interval during which the participants had to form a mental image corresponding to the name spoken aloud while keeping their eyes closed or looking at the screen. The picture was then displayed on the screen, and the participants had to rate the degree of match between the picture and their generated mental image on a 5-point scale (where 1 = *low agreement* and 5 = *high agreement*).

In the familiarity task, the participants were required to evaluate “how usual or unusual the object depicted in each picture was in their realm of experience.” Familiarity was defined as “the degree to which you come into contact with or think about the concept.” The participants were told to rate the concept itself, and not the way it was drawn, on a 5-point Likert scale (5 = *high familiarity*, 1 = *low familiarity*).

For the imageability and AoA tasks, the ratings were performed on the basis of the written modal names. A booklet containing all the modal names was prepared. A 5-point scale was printed below each modal name. As far as the imageability ratings are concerned, we closely adhered to the instructions provided by Paivio et al. (1968). The participants had to rate the ease of generating a mental image on the basis of the (modal) name, using a 5-point scale, where 1 = *difficult* and 5 = *easy*. We clearly explained to the participants that they could generate different types of images other than purely visual images (e.g., auditory, olfactory, motor images). It should be noted that although the imageability variable is similar to the concreteness variable, the two nevertheless differ in that in the latter case, participants are asked to judge how easy or difficult it is to experience with the senses the object referred to by the written word.

In the AoA task, the participants had to estimate the age at which they thought they had learned each of the names in its written or oral form. AoA was rated on a 5-point scale and divided into ranges of 3 years (0–3 at one extreme and 12+ at the other). The values were then converted to numerical values, with 1 = *learned between 0–3 years* and 5 = *learned at age 12 or after.*

Like Székely and Bates (2000), we included an objective measure of visual complexity—namely, the size of the pictures in JPEG format. As was explained above, we did not include a visual complexity rating task of the type used in similar studies, because the task did not appear to be suitable for colorized drawings. In addition to the measures described above, we added three measures of word length: number of letters, phonemes, and syllables.

Results and discussion

The mean ratings collected for each stimulus are presented in a computer file (Excel file) available electronically on the Internet. The items are listed alphabetically according to the English names of the pictures. Starting from the leftmost column, the following information is provided for each item. (1) The number of the picture, the name of the picture in both English and French in the Rossion and Pourtois (2004) database, the intended Russian name, and the most common (modal) Russian name[1] are given. (2) Two measures of name agreement corresponding to the percentage of participants giving the most common name and the *H* statistic (as described in Snodgrass & Vanderwart, 1980) are provided. (3) The means and the standard deviations for image agreement, conceptual familiarity, imageability, rated AoA, and objective visual complexity are given. The number of letters, syllables, and phonemes of the modal names are provided. The word frequency values (taken from *New Frequency Dictionary of Russian Vocabulary*; Lyashevskaya & Sharov, 2008) of the modal names are also provided whenever available. A dash ("–") indicates that the single name (modal name) was not listed in the corpus. (4) The response percentages based on the classification into four different lexical categories used by D'Amico, Devescovi, and Bates (2001) and described below are given.

The supplemental material also provides an Excel file with the different nonmodal names provided for each item, together with their corresponding frequencies of occurrence. In addition, for each item, the number of DKO, DKN, and TOT responses are indicated.

Reliability of the image agreement, imageability, subjective frequency, and AoA norms

Table 1 reports the correlations between the different scores obtained from the means of the even and odd participants and the intraclass correlation coefficients [random effects of both participants and items—ICC(2, *k*) in Shrout and Fleiss's (1979) terminology].

The reliability of the different norms is high, with the exception of the image agreement scores, for which the reliability is a little lower. This suggests that there is greater individual variation in the way the image agreement task is performed when colorized pictures, rather than black-and-white drawings, are used. It should be remembered, however, that the influence of image agreement on naming times was clearly reduced in response to the colorized drawings in the Weekes et al. (2007) study.

Comparisons of the present norms with those obtained using the same set of colorized pictures and those obtained using the standard black-and-white drawings

Two measures of name agreement were computed: the *H* statistic and the percentage of participants producing the modal name (%*NA*). The *H* value equals 0 when the modal name is provided by all participants (without DKN, DKO, and TOT taken into account). Increasing *H* values indicate decreasing levels of name agreement. As was pointed out by Snodgrass and Vanderwart (1980), the heterogeneity of the names given to a picture is better indexed by the *H* measure than by the percentage of agreement.

Table 1 Correlation (*r*) between even and odd participants and ICC index

	r(even, odd)	ICC
IA	.77	.84
Imag	.91	.90
Fam	.95	.93
AoA	.95	.95

IA = image agreement; Imag = imageability; Fam = conceptual familiarity; AoA = rated age of acquisition

The correlation coefficients between the present norms and those obtained for the same set of colorized pictures in Belgian French by Rossion and Pourtois (2004) and in Modern Greek by Dimitropoulou et al. (2009) are shown in the left panel of Table 2. The right panel reports the correlation coefficients of the present data with norms obtained with the original black-and-white pictures in American English (Snodgrass & Vanderwart, 1980), French (Alario & Ferrand, 1999, and Bonin et al., 2003, for imageability), and Spanish (Sanfeliù & Fernandez, 1996).

Before comparing the norms obtained in the different studies set out above with the present ones, it is worth mentioning an important concern relating to the Rossion and Pourtois (2004) name agreement scores. We have performed several analyses of their scores and have come to the unfortunate conclusion that these can no longer be used for comparisons with the other norms. First of all, whereas our and the Greek name agreement scores are relatively highly correlated, as can be seen from Table 2, for both the %*NA* and the *H* statistic, the correlations between our name agreement scores and theirs are close to zero. This was also the case when we considered the Greek norms (Dimitropoulo et al., 2009). Given these surprising outcomes, we decided to correlate their name agreement scores collected for the stimuli in the three conditions (original line drawings, gray levels, colorized) not only with the norms obtained in Greek for the same set of colorized pictures (Dimitropoulo et al., 2009), but also with the name agreement norms for the black-and-white drawings obtained in French (Alario & Ferrand, 1999), American English (Snodgrass & Vanderwart, 1980), and Spanish (Sanfeliù & Fernandez, 1996). The correlations were also all close to zero and not significant. In contrast, the correlations between the different name agreement scores obtained in the other languages were all reliably different from zero. Second, since the analyses above suggested that comparisons with the Rossion and Pourtois name agreement norms might be uninformative, we decided to correlate their naming times (which can be

[1] The first author, who is a native speaker of Russian, examined the names and judged whether they should be counted as the same name or as different names. Furthermore, whenever a spelling mistake was made on a given name, it was considered as "correct" if the spelling mistake was phonologically plausible or took the form of a missing letter or an inappropriate plural mark.

Table 2 Correlations of name agreement (% and *H*), image agreement, conceptual familiarity, imageability, and age-of-acquisition scores in the present study with the scores obtained in other studies conducted with the colorized pictures (R & P, D. et al.) and with the black-and-white drawings (S & V, A & F, B. et al., S & F)

	R & P	D et al.	S & V	A & F	B et al.	S & F
NA (%)	−.03 [.64]	.48 [*]	.25 [*]	.26 [*]$^{(258)}$		.35 [*]$^{(254)}$
NA (*H*)	−.02 [.74]	.55 [*]	.25 [*]	.26 [*]		.32 [*]$^{(254)}$
IA	.48 [*]		.42 [*]	.49 [*]$^{(258)}$		.48 [*]$^{(246)}$
Fam.	.83 [*]		.78 [*]	.83 [*]$^{(258)}$		.71 [*]$^{(254)}$
Imag.					.36 [*]$^{(253)}$	
AoA		.72[*]	.59 [*]$^{(89)}$	.61 [*]$^{(259)}$		

NA = name agreement (% = percentage of participants giving the most common name; *H* = *H* statistic); IA = image agreement; Fam. = conceptual familiarity; Imag. = imageability; AoA = rated age of acquisition; R&P = Rossion and Pourtois (2004); D et al. = Dimitropoulou, Duñabeitia, Blitsas, and Carreiras (2009); S & V = Snodgrass and Vanderwart (1980); A & F = Alario and Ferrand (1999); B et al. = Bonin, Peereman, Malardier, Méot, and Chalard (2003); S & F = Sanfeliù and Fernandez (1996). When different from the total number of items (260), the number used for the computations is given in parentheses. *p*-values are indicated in brackets; a "*" is used when these are lower than .001

obtained from their Appendix 1 available online at http://www.perceptionweb.com/misc/p5117/) with their name agreement scores (also presented in their Appendix 1). Once again, the result of this analysis was striking. Contrary to a well-established finding in the spoken naming literature, the correlations were unreliable and close to zero (i.e., .06 [p = .32] for *H* and .08 [p = .19] for %*NA*). For instance, in Bates et al.'s (2003) study, the lowest correlation obtained for seven languages was .59 (see also Vitkovitch & Tyrrell, 1995). Moreover, the absolute values of the correlations between the Rossion and Pourtois naming times and the name agreement scores taken from both the present research and the Greek study varied between .33 and .52 (all *p*s < .001).

Although the analyses above suggest that the Rossion and Pourtois (2004) name agreement norms can no longer be used for comparisons with the other norms, it is important to note that the distributions of the Belgian name agreement (*H* or %*NA*; see Fig. 1) exhibit the classical features of these measures—that is to say, a high mean and a large negative skew for %*NA* (and the reverse for the *H* statistic), an outcome that suggests that the discrepancy could be due to certain problems in the organization (sequencing) of the items provided by Rossion and Pourtois when reporting name agreement scores.

If we now consider the correlations of our name agreement scores with those obtained in the other studies, important differences can be observed between the colorized pictures (Dimitropoulou et al., 2009) and the black-and-white line drawings. These suggest that the addition of color to the drawings significantly changes the naming behavior (as was found by Rossion & Pourtois, 2004). Finally, it should be noted that the correlations between the name agreement scores obtained for the line drawings in other languages, on the one hand, and those obtained for the colorized pictures, on the other, are lower in Russian than in Modern Greek, for which the *H* statistic varies between .38 and .53.

The correlations concerning image agreement are very homogeneous, but a little lower than those reported in Spanish (Sanfeliù & Fernandez, 1996), French (Alario & Ferrand, 1999), and American English, for which the values vary between .50 and .56.

The majority of normative studies (e.g., Alario & Ferrand, 1999; Dell' Acqua, Lotto & Job 2000; Sanfeliù & Fernandez, 1996) have shown that interlanguage correlations are generally higher for dimensions that are not directly derived from the pictures themselves. In our study, this was observed, in particular, for AoA and conceptual familiarity, for which the correlations were comparable to those reported in the studies mentioned above. The imageability scores represent an important exception, since these scores were poorly correlated with the norms collected by Bonin et al. (2003). This finding is intriguing, since high correlations have been found between the French (Canadian) imageability norms (e.g., Desrochers & Thompson, 2009), on the one hand, and between those found in French and in English, on the other (Bonin, Ferrand, Méot, & Roux, 2011). Since, to our knowledge, no imageability norms have been published for Russian, we are not able to explain the reason for this low correlation.

In-depth examination of name agreement scores and comparisons with other studies using the same stimuli

Of the 260 pictures, 35 yielded a single name, 55 two names, 50 three names, 31 four different names, and 30 five names. More than five names were given to 59 of the pictures. The numbers of naming failures (the occurrence of DKN, DKO, and TOT states) are given for each item. The mean rate of naming failures across the three categories (DKN, DKO, and TOT) was 1% and is close to the value

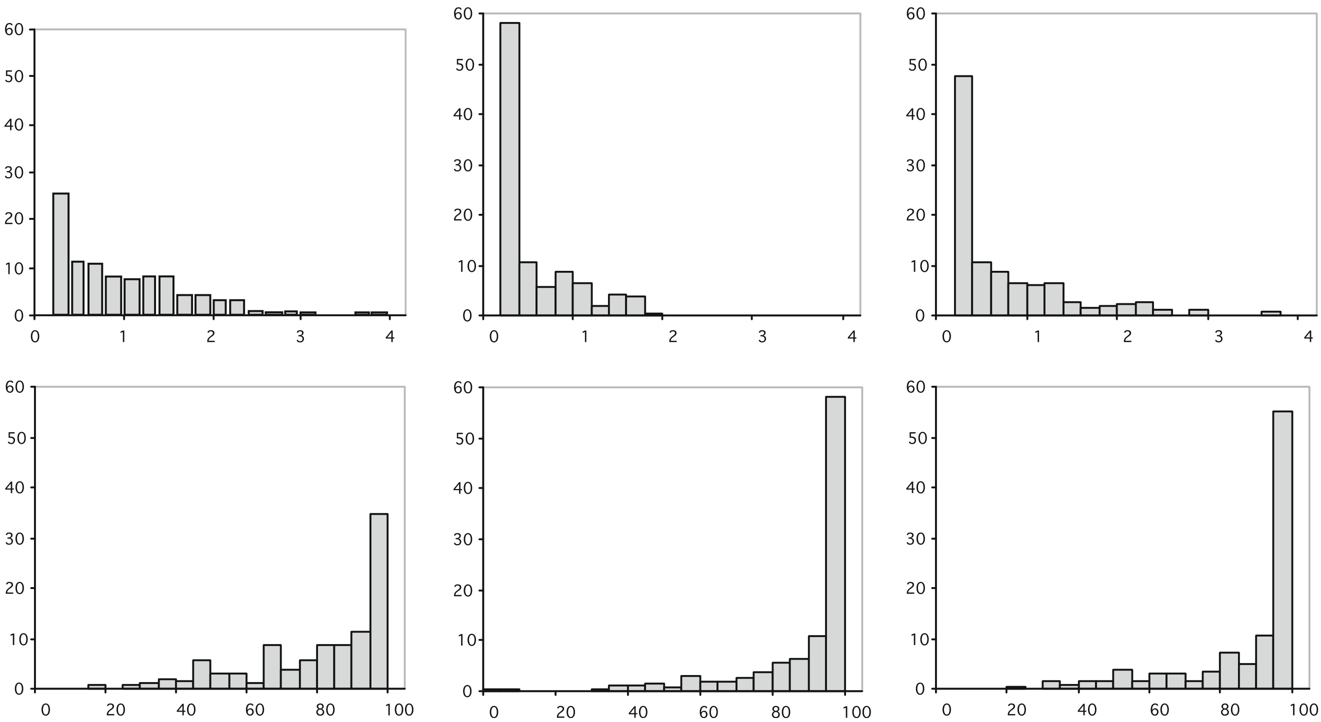

Fig. 1 Frequency distribution of the name agreement characteristics. Top, *H* statistic; bottom, percentage of participants giving the most common name (%*NA*). Left, Russian; center: Rossion and Pourtois (2004); right, Dimitropoulo, Duñabeitia, Blitsas, and Carreiras (2009)

obtained in French by Alario and Ferrand (1999), but slightly lower than those reported for English (1.75%) and Spanish (4.15%). A closer examination of the 13 items for which there were more than 5% naming failures revealed that these items were often the same across one or more languages (French, Spanish, or American English). The rate of naming failures was higher than 5% in Russian and in at least two other languages for the following items: *artichoke*, *asparagus*, *celery*, *chisel*, *nut*, *pliers*, *plug*, and *raccoon*. A failure rate of more than 5% was found in the three other languages, but not in Russian, for the items *French horn*, *wagon*, and *wrench*.

TOT states are momentary failures of lexical retrieval and have been accounted for by assuming that there is a deficit in the transmission of activation from the semantic level to the lexical level (e.g., Bock & Levelt, 1994; Levelt, Roelofs, & Meyer, 1999; Meyer & Bock, 1992). The rate of TOT states on objects in Russian was 0.37%, which is lower than the rates obtained in the previously mentioned studies (i.e., English [0.74%], French [0.62%], and Spanish [1.98%]). Overall, the percentage of TOTs is less than that generally found for proper names (e.g., 17% in the French normative study of Bonin et al., 2008).

Table 3 shows the descriptive statistics for name agreement scores obtained in Russian, alongside those obtained on the same set of pictures by Rossion and Pourtois (2004) in French and Dimitropoulou et al. (2009) in Modern Greek. The mean, median, and Q3 of the percentage scores show that the name agreement scores are globally high. The classical positive (for the *H* statistic) and negative (for the %*NA*) skew is also observed. However, the %*NA* scores are lower, more variable, and less skewed than those reported in other studies that have used the same colorized pictures. The reverse is observed for the *H* statistic.

Table 3 Descriptive statistics for name agreement scores obtained in the present study and those obtained on the same set of pictures by Rossion and Pourtois (2004) in French and Dimitropoulou, Duñabeitia, Blitsas, and Carreiras (2009) in Modern Greek

	Present Study		R & P		D et al.	
	%	*H*	(%)	(*H*)	(%)	(*H*)
Mean	80.63	.82	90.26	.32	87.45	.55
SD	19.64	.73	16.95	.46	17.71	.68
Median	88.04	.64	100.00	0	96.78	.24
Q1	69.57	.15	85.75	0	82.39	.05
Q3	95.65	1.30	100.00	.61	99.39	.85
IQR	26.08	1.15	14.25	.61	17	.8
Range	82.61	3.71	100.00	1.65	77.52	3.51
Min	17.39	0	0	0	22.48	0
Max	100.00	3.71	100.00	1.65	100.00	3.51
Skewness	−1.06	1.03	−2.27	1.25	−1.63	1.69

Note. % = percentage of participants giving the most common name ; *H* = *H* statistic; R & P = Rossion and Pourtois (2004); D et al. = Dimitropoulou et al. (2009); *SD* = standard deviation; Q1 = 25th percentile ; Q3 = 75th percentile; IQR = interquartile range

As is shown in Fig. 1, the number of pictures for which all the participants gave the same modal name was much lower in Russian than in the two other languages (Greek and French). At the same time, although agreement levels were high for most of the pictures, the participants also provided many alternative responses. As a result, the distribution decreases more gradually from the mode. To study these discrepancies in greater depth, we identified the items for which (1) the %*NA* scores in Russian were at least one standard deviation (18%) below the *%NA* scores of all the other languages except one and (2) the *H* statistics in Russian were at least two standard deviations above the *H*'s of all the other languages except one, with the mean and standard deviation being computed over all items in all languages. The *except-one* condition was used to ensure that we identified items for which the scores in two languages, including Russian, were very different from those obtained in the other languages. The application of these criteria resulted in the identification of 29 items.

An in-depth examination of these 29 items revealed the following. For 7 items, we found that the discrepancies could be accounted for in terms of cultural differences, whereas for 20 items, they were most probably attributable to linguistic differences. For the remaining 2 items, we were left with no satisfactory explanation. To illustrate the discrepancies in terms of cultural differences, let us take the items *church* and *accordion* as examples. With regard to *church*, it is worth mentioning that while Russia is a country of many religions (Christianity, Islam, Buddhism, and Judaism are Russia's traditional religions, but there are also smaller Christian denominations, such as Catholics, Armenian Gregorians, and various types of Protestantism), the dominant religion is Russian Orthodoxy. Since the picture of a church used in the normative study did not correspond to the appearance of an Orthodox church of the type that is widespread in Russia, it is not surprising that we found a huge variety of alternative names for this item ("кирха," meaning *Lutheran church*; "костёл," meaning (Polish) *Roman Catholic church*; "церковь католическая," meaning *Catholic church*; "собор," meaning *cathedral*; etc.). As far as the second example (the item *accordion*) is concerned, in Russia there are many different and widely used kinds of accordions, such as the *harmonica* and the *button accordion* types, which are very often used in folk

Table 4 Means, standard deviations (*SD*s), and the ranges corresponding to the percentages of responses according to the classification in four different lexical categories used by D'Amico, Devescovi, and Bates (2001)

	Russian All	Russian Partial	English All	English Partial	7 Languages All	7 Languages Partial
H						
Mean	0.82	0.75	0.67	0.5	0.88 [0.67; 1.16]	0.69 [0.5; 0.98]
SD	0.73	0.68	0.61	0.54	0.72 [0.61; 0.79]	0.66 [0.54; 0.75]
Range	0–3.71	0–3.71	0–2.89	0–2.89	0–3.57	0–3.17
% Lex 1 dominant						
Mean	80.6	82.3	85	89.3	79 [71.9; 85]	83.8 [76.4; 89.3]
SD	19.6	18.0	16.4	13.9	20.9 [16.4; 23.3]	19 [13.9; 22.2]
Range	17.4–100	17.4–100	28–100	31.4–100	11–100	13–100
% Lex 2 phonetic variance						
Mean	7.8	6.9	3.7	2.6	5.1 [3.2; 8.5]	4.1 [1.9; 8.1]
SD	12.4	10.6	8.7	7.1	10.6 [8.4; 12.9]	9.4 [6.3; 12.1]
Range	0–58.7	0–47.8	0–68	0–42	0–70	0–63
% Lex 3 synonym						
Mean	3.7	3.2	2.4	1.2	3.3 [1.6; 5.2]	2.4 [1.0; 4.1]
SD	8.8	7.9	7.7	4.9	8.9 [5.5; 11]	7.7 [3.8; 10.6]
Range	0–50	0–50	0–49	0–40	0–60	0–57
% Lex 4 erroneous						
Mean	6.9	6.5	9	6.9	12.5 [9; 18]	9.7 [6.9; 14.5]
SD	12.7	12.2	12.4	11.3	16.7 [12.4; 19.8]	15.3 [11.3; 18.3]
Range	0–69.6	0–65.2	0–63.3	0–51.1	0–88	0–88

% = percentage of participants giving a name pertaining to the category; Lex = lexical category; Russian all = for the 260 Snodgrass and Vanderwart (1980) pictures; English and 7 languages all = for the 520 pictures normed by Bates et al. (2003); Russian, English, and 7 languages partial = for the Snodgrass and Vanderwart pictures present in both databases.

For the 7-languages specifications, mean, *SD*, and range were computed using the scores across all languages; the intervals provide the range of means and *SD*s computed separately for each language as reported by Bates et al.

Table 5 Descriptive statistics for image agreement, conceptual familiarity, age of acquisition, and imageability scores in the present study, Rossion and Pourtois (2004), Snodgrass and Vanderwart (1980), Alario and Ferrand (1999), Sanfeliù and Fernandez (1996), Dimitropoulou, Duñabeitia, Blitsas, and Carreiras (2009), and Bonin, Peereman, Malardier, Méot, and Chalard (2003)

	Image Agreement				
	Present	R&P	S&V	A&F	S&F
N	260	260	260	258	246
Mean	4.34	3.74	3.69	3.46	3.71
SD	0.36	0.74	0.59	0.78	0.60
Median	4.41	3.83	3.72	3.60	3.83
Q1	4.16	3.19	3.25	2.93	3.30
Q3	4.59	4.25	4.15	4.04	4.16
IQR	0.43	1.06	0.90	1.11	0.86
Min	2.41	1.75	2.05	1.17	1.74
Max	4.97	5.00	4.73	4.90	4.77
Range	2.56	3.25	2.68	3.73	3.03
Skew	−1.60	–0.45	–0.42	–0.70	–0.71
	Conceptual Familiarity				
	Present	R&P	S&V	A&F	S&F
N	260	260	260	258	254
Mean	3.80	3.43	3.29	3.06	3.12
SD	0.78	1.01	0.96	1.21	1.11
Median	3.85	3.53	3.35	2.90	3.06
Q1	3.23	2.53	2.48	1.96	2.16
Q3	4.53	4.34	4.15	4.15	4.09
IQR	1.3	1.81	1.67	2.19	1.93
Min	1.61	1.53	1.18	1.07	1.27
Max	4.92	5.00	4.90	4.97	4.94
Range	3.31	3.47	3.72	3.90	3.67
Skew	−0.39	–0.15	–0.09	0.09	0.02
	AoA				
	Present	D et al.	S&V	A&F	
N	260	260	89	259	
Mean	1.93	2.42	3.09	2.26	
SD	0.56	0.57	1.03	0.67	
Median	1.77	2.38	2.94	2.20	
Q1	1.52	2.03	2.30	1.76	
Q3	2.19	2.77	3.89	2.72	
IQR	0.67	0.74	1.59	0.96	
Min	1.19	1.28	1.34	1.12	
Max	4.29	4.08	5.48	4.62	
Range	3.10	2.80	4.14	3.50	
Skew	1.31	0.33	0.51	0.57	
	Imageability				
	Present	B et al.			
N	260	253			
Mean	4.45	4.49			
SD	0.47	0.42			
Median	4.56	4.60			
Q1	4.26	4.36			
Q3	4.79	4.76			
IQR	0.53	0.40			
Min	1.71	1.92			
Max	4.97	5.00			
Range	3.26	3.08			
Skew	−1.93	−2.62			

AoA = rated age of acquisition; R&P = Rossion and Pourtois (2004); D et al. = Dimitropoulou et al. (2009); S&V = Snodgrass and Vanderwart (1980); A&F = Alario and Ferrand (1999); B et al. = Bonin et al. (2003); S&F = Sanfeliù and Fernandez (1996); *N* = number of observations; *SD* = standard deviation music. As a result, only 52.2% of participants gave the answer *accordion*, and the remaining 43.5% provided alternative names such as "гармонь," **"**гармошка," meaning *harmonica***,** and "баян," meaning *button accordion*. With regard to linguistic differences, as we state in the introduction, it should be remembered that the Russian language is characterized by an extremely rich system of derivational and inflectional morphology. Thus, for many items, the participants used many morphological or morphophonological alternations of the target name, including diminutives, masculine and feminine forms, plural/singular alternations or expansions, and a variety of synonyms. The Russian diminutive system is a very complex one, allowing nouns, adjectives, and adverbs to possess double or even triple diminutive derivations, with the result that for nonnative speakers of Russian, it may sometimes be difficult to connect a nickname to its original name. Russian possesses a variety of diminutive suffixes, which can be used alone or in combination to create subtle changes in meaning (Voeykova, 1998). The semantics of diminutive forms in Russian is multifunctional and can be used to express the diminutive (small size), as well as to represent different emotions (addressed to pets, sympathy, ironic sympathy, pejoratively, to indicate the incompleteness of the appearance of an attribute, inaccuracies in its description, etc.). For example, for the item *cat*, the participants used "кошка," meaning *cat* (feminine form), together with several alternative names: "кот," meaning *cat* (masculine form); "киска" as the diminutive name for *cat* (feminine form); "киса сиамская," meaning *Siamese cat*. For the item (the concept) *potato*, the participants primarily used "картошка," the informal diminutive name for *potato*, as well as alternative names such as "картофель," meaning *potato*; "картофелина," meaning *one piece of potato*; and "клубень картофеля," meaning *potato tuber*. (All these names have the same root, and there are morphological alternations reflecting different nuances of the concept of potato.)

The means, the standard deviations, and the ranges corresponding to the response percentages based on the classification into four different lexical categories used by D'Amico et al. (2001) are reported in Table 4. The valid responses were coded into four different lexical categories with different relations to the modal names. The first category (L1) corresponds to the (target) modal name. The second category (L2) includes any morphological or morphophonological alternation of the target name. More precisely, it corresponds to lexical variations to a given word root or a key portion of it without changing its core meaning. Included in this category are abbreviations (diminutives; e.g., *little lock* ["*замочек*"] for *lock* ["*замок*"]), plural/singular alterations (e.g., *gloves* ["*перчатки*"] when the target word was *glove* ["*перчатка*"]), feminine/ masculine gender, reductions, or expansions (e.g., *maple leaf* ["*кленовый лист*"] for *leaf* ["*лист*"]). In the third category (L3), we find synonyms for the target name. These are different from the lexical responses belonging to the second category, because they do not share the word root or key portion of the target word (e.g., *ass* ["*ишак*"] for *donkey* ["*осёл*"], or *sofa* ["*софа*"] for *couch* ["*диван*"]). Finally, the fourth category (L4) contains all the lexical responses that could not be classified in the other categories, including coordinates (e.g., *guitar* for *harp*), hyponyms (e.g., *primate* ["*примат*"] for *monkey* ["*обезьяна*"]), semantic associates (e.g., *she-goat* ["*коза*"] for *sheep* ["*баран*"]), part–whole relations at the visual-semantic level (e.g., *leg* ["*нога*"] for *foot* ["*стопа*"]), and all obvious visual errors or completely unrelated responses.

In Table 4, we also report the statistics for English and for the seven languages corresponding to the set of pictures studied by Bates et al. (2003). We distinguish between the full set of 520 items used by Bates et al. and the specific set corresponding to the Snodgrass and Vanderwart (1980) pictures.[2] An examination of Table 4 suggests that the differences in the distributions of name agreement scores between Russian and (Belgian) French or Modern Greek, and especially when compared with English, are due mainly to the more widespread use of morphological or morphophonological alternations, diminutives, and expansions and, although to a lesser extent, the use of synonyms of the target names. It is worth stressing that the differences are not due to a high level of production of "erroneous" responses.

In-depth examination of the other subjective norms (image agreement, familiarity, AoA, and imageability) and relationship with other published studies

Table 5 reports descriptive statistics for image agreement, conceptual familiarity, AoA, and imageability scores. Both the image agreement and familiarity scores are globally higher and more homogeneous than those found in other languages (French, Greek, English, and Spanish). The negative skew of the image agreement scores is also more marked and indicates that the items are clustered more tightly around high image agreement values. The fact that AoA ratings are lower for equivalent items and are less

[2] The English norms were taken from the CRL-IPNP Web site accompanying the work of Bates et al. (2003). Given that the Snodgrass and Vanderwart (1980) pictures are not clearly listed in this database, we had to check which pictures belonged to the Snodgrass and Vanderwart set. Since this was not completely feasible, the norms corresponding to two pictures were set apart, because they could have belonged to two different databases, while five non-identifiable items were from another database used by Bates et al.

Table 6 Correlations among the measured variables

	H	IA	Fam	VC	Imag	AoA	Freq	Letters	Syll	Phon
%*NA*	−.96***	.49***	.13*	−.49***	.25***	−.37***	.09	−.08	−.06	−.07
H		−.55***	−.15*	.54***	−.27***	.37***	−.07	.08	.04	.06
IA			.08	−.59***	.19**	−.17**	−.01	.02	.01	.01
Fam				−.25***	.82***	−.58***	.46***	−.06	−.03	−.06
VC					−.37***	.39***	−.29***	.08	.10	.07
Imag						−.60***	.41***	−.06	−.01	−.05
AoA							−.47***	.29***	.19**	.27***
Freq								−.25***	−.26***	−.27***
*N*let									.84***	.98***
*N*syl										.87***

NA = name agreement (*H* = *H* statistic; %*NA* = percentage of participants giving the most common name); IA = image agreement; Fam = conceptual familiarity; VC = visual complexity; Imag = imageability; AoA = age of acquisition; Freq = word frequency (log transformed) from Lyashevskaya and Sharov, 2008; Letters = number of letters; Syll = number of syllables; Phon = number of phonemes

*p < .05

**p < .01

***p < .001

variable, but more skewed, indicates that the items are grouped around the mean. Imageability scores are comparable to the French values.

Correlational analyses Correlational analyses were performed on the data (see Table 6). Ten items, for which word frequency counts were not available, were excluded from the analyses. Frequency was first log-transformed to reduce the positive skew.

The correlations are generally similar to those reported in other normative studies using pictures. One notable exception is visual complexity, for which, if we disregard its correlation with conceptual familiarity, the absolute values of the correlations with the other variables were higher. It should be remembered, however, that we used objective visual complexity scores, and not the more conventional subjective visual complexity scores. Furthermore, %*NA* and *H* were more positively correlated with one another and with image agreement than has been observed in other studies. A final observation concerns the high correlation between familiarity and imageability. This finding, however, is not particularly surprising, given that the two variables are thought to be reliable indexes of semantic code activation (Cuetos & Barbon, 2006; Shibahara et al., 2003).

Factor analysis A factor analysis provides us with further information about the internal structure among the variables in our normative database, We performed a principal component factor analysis using the varimax rotation method (i.e., maximizing the sum of the variance of the squared loadings). In these analyses, only the *H* statistic for name agreement was considered, because (1) *H* is a more common measure of name agreement and (2) using both name agreement measures would have given too much weight to the name agreement variables. The two factors with eigenvalues above 1 were retained and accounted for 38% and 32% of the variance, respectively.

Table 7 shows the loadings of the variables. Factor 1 loads on variables that are related to the concepts depicted by the pictures, and not to their precise visual depiction (conceptual familiarity, imageability, AoA, and objective frequency). The second factor loads mainly on the variables related to the agreement between the pictures and their names or between the pictures and their structural representations (name agreement and image agreement). Visual complexity is primary associated with the dimension expressed on the second factor. However, as can be seen from Table 7, objective visual

Table 7 Factor analysis (varimax rotation)

Variable	Factor	
	1	2
H	−.11	.84
IA	.00	−.88
Fam	.89	−.05
VC	−.30	.79
Imag	.84	−.24
AoA	−.75	.29
Freq	.72	.02

H = name agreement (*H* statistic); IA = image agreement; FAM = conceptual familiarity; VC = visual complexity; Imag = imageability; AoA = age of acquisition; Freq = word frequency (log transformed) from Lyashevskaya and Sharov (2008) complexity is also expressed on the first factor, thus suggesting that more visually complex pictures tend to possess less frequent and later acquired names and are underpinned by less familiar and less imageable concepts.

Conclusion

The aim of our study was to provide normative data in Russian for the *colorized version* of the Snodgrass and Vanderwart (1980) pictures (available for free download at http://www.nefy.ucl.ac.be/facecatlab/stimuli.htm). The choice of these pictures, instead of the more traditional black-and-white drawings, was motivated by the fact that faster and more accurate naming performances have been obtained with the former than with the latter. This normative database for pictorial material, available upon request from the second author or directly from the Psychonomic Society's supplemental archive, should be useful for future research into memory, as well as language production and comprehension in Russian adults.

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