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A Database of Psycholinguistic and Lexical Properties for French Adjectives Referring to Human and/or Nonhuman Attributes

Susanne Quadflieg
New York University Abu Dhabi and Psychological Sciences Research Institute, Université catholique de Louvain

Caroline Michel, Henryk Bukowski, and Dana Samson
Psychological Sciences Research Institute, Université catholique de Louvain

The processing of human and nonhuman concepts (e.g., *agreeable* vs. *edible*) during basic comprehension and reasoning tasks has become a major topic of scientific inquiry. To ensure that the experimental effects obtained from such studies reflect the hypothesised semantic distinction, potential confounds such as psycholinguistic and/or lexical properties of the exact stimuli chosen need to be addressed. In the current study, normative data of such properties were obtained for a series of 875 French adjectives by asking 8 groups of 20 participants to each rate all words on one dimension of theoretical interest. The collected ratings indicate the extent to which each adjective evokes a sensory experience (concreteness), captures an enduring attribute (temporal stability), refers to a visible characteristic (visibility), denotes a neutral or an affectively laden concept (valence), signifies an attribute of low or high intensity, is familiar to the reader and can be used to describe people and/or inanimate entities such as objects. In addition, for each item its exact grammatical class (adjective vs. past participle adjective), length (i.e., number of letters, number of syllables), and word frequency was retrieved from the lexique3 corpus. The resulting database enables researchers to consider pivotal psycholinguistic and lexical properties when selecting human and nonhuman stimuli for future research.

Keywords: state knowledge, social concepts, trait knowledge, word ratings

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Although many people would find it rather simple to form an impression of a person described as *kind*, *supportive*, and *affectionate*, the question of how the human mind stores, organizes and integrates social information is far from trivial. Importantly, an individual's repository of person knowledge not only provides the basis for retrieving the meaning of literally thousands of words, but also holds the elementary units for many higher-order social–cognitive operations, such as mentalising (i.e., to ponder about the mental states of other agents, see Premack & Woodruff, 1978; Samson & Apperly, 2010), individuating or stereotyping (i.e., to make sense of other people based on their unique attributes or their social group memberships, see Fiske & Neuberg, 1990; Quadflieg & Macrae, 2012) and anthropomorphising (i.e., to attribute human characteristics to objects or animals, see Epley, Waytz, & Cacioppo, 2007; Heider & Simmel, 1944). Given that intact social reasoning skills are of pivotal significance in everyday life (e.g., Fletcher & Frith, 2009; Gilbert, Meuwese, Towgood, Frith, & Burgess, 2009), it is unsurprising that researchers have begun to expend considerable effort on studying the representation and organisation of person concepts.

According to contemporary theories of knowledge representation, the human brain structures conceptual information along selected domains of evolutionary significance (Caramazza & Shelton, 1998; Mahon & Caramazza, 2009; Martin, 2007). Though the number and scope of relevant domains remains an issue of debate, animals, fruits/vegetables, tools, and conspecifics (i.e., humans) are often listed as viable examplars. Supporting the idea of domain-based knowledge representation are neuropsychological reports of brain-damaged patients with highly specific semantic deficiencies (e.g., Capitani, Laiacona, Mahon, & Caramazza, 2003; Humphreys & Ford, 2001; Tyler & Moss, 2001; Warrington & Shallice, 1984). Patients with impairments for animals, for instance, may fail to name animals from pictures and/or to answer questions about them (e.g., such as *Does a whale have legs?*), while performing within normal range when naming or answering questions about entities that do not belong to the impaired category (i.e., about fruits/vegetables or tools).

Although conspecifics have sometimes been declared an independent domain of knowledge organisation, this claim rests largely upon research with patients who failed to name or retrieve autobiographical information about familiar others (Ellis, Young, & Critchley, 1989; Lambert, Swain, Miller, & Caine, 2006; Miceli et al., 2000). Whether general person knowledge (such as infor-

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Susanne Quadflieg, Division of Psychology, New York University Abu Dhabi, Abu Dhabi, United Arab Emirates and Psychological Sciences Research Institute, Université catholique de Louvain, Louvain-la-Neuve, Belgium; Caroline Michel, Henryk Bukowski, and Dana Samson, Psychological Sciences Research Institute, Université catholique de Louvain.

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Correspondence concerning this article should be addressed to Susanne Quadflieg, Division of Psychology, New York University Abu Dhabi, P. O. Box 129 188, Abu Dhabi, U.A.E. E-mail: susanne.quadflieg@nyu.edu

mation providing the answer to the question "*Can a person be seedless?*") may be selectively compromised by brain damage remains uncertain. Recent neuroimaging evidence suggests, however, that the activation of person knowledge compared to other types of world knowledge draws upon a specialized neural network, comprising the medial prefrontal cortex (MPFC), the temporoparietal junctions (TPJ), and the anterior temporal lobes (aTL; for reviews, see Adolphs, 2009; Simmons & Martin, 2009; Van Overwalle, 2011).

To identify this network, researchers have frequently presented healthy participants with person and nonperson targets (i.e., exemplars of people and different types of fruit, clothing, or animals) in combination with a series of attributes (e.g., *honest* vs. *seedless*), activities (e.g., *jump* vs. *ferment*), or body parts (e.g., *hand* vs. *tail*). Participants' task was to judge whether the latter could be descriptive or be applied to the former (see Mason, Banfield, & Macrae, 2004; Mitchell, Heatherton, & Macrae, 2002; Mitchell, Banaji, & Macrae, 2005). Given that each descriptor (i.e., each attribute, activity, and body part) was shown once in combination with a human target and once in combination with a nonhuman target, neural differences observed across experimental conditions (i.e., person vs. nonperson judgments) were unlikely to be influenced by any psycholinguistic or lexical properties of the exact descriptors chosen.

Unfortunately, this elegant experimental approach suffers from an important theoretical limitation. It cannot distinguish whether differences in brain activity arise because of the activation of different types of knowledge across experimental conditions (i.e., the same concept may carry a different meaning depending on the context it is activated in) or because of different ways of attributing/applying knowledge to a human versus a nonhuman target. To address this short-coming, researchers have begun to develop new experimental paradigms to elucidate the representation of person knowledge. Zahn and colleagues (2007), for instance, presented word pairs consisting of nonhuman (e.g., *nutritious-useful*) or human (e.g., *tactless-impolite*) concepts and asked their participants to judge whether the two words of each pair were related in meaning. By doing so, participants were required to access all concepts in terms of their semantic content but without relating them to a specific target. As a result, variations in brain activity across experimental conditions signalled differences in knowledge representation per se rather than differences in attribution processes for person relative to nonperson entities.

Adopting this alternative experimental approach, however, poses additional challenges. When comparing the processing of human versus nonhuman attributes, neural differences across experimental conditions can only be reliably associated with the semantic distinction of interest if no other systematic variations exist for the two sets of stimuli. While Zahn and coworkers (2007, 2009), as well as researchers using their material (e.g., Ross & Olson, 2010; Skipper, Ross, & Olson, 2011), carefully matched or statistically controlled for numerous psycholinguistic and lexical properties across conditions, several subsequent studies addressed only few if any of these variables (e.g., Contreras, Banaji, & Mitchell, 2011; Simmons, Reddish, Bellgowan, & Martin, 2010; Wong, Harris, & Gallate, 2012). This oversight is likely to be traced back to the following reasons. Not only is it unclear which exact psycholinguistic and lexical properties should be considered in these studies, in addition normative data capturing these properties are often lacking.

Psycholinguistic and lexical properties of relevance during word processing can be manifold. A concept's valence, intensity, familiarity, concreteness, and imageability have received occasional attention in the social cognition literature (e.g., Contreras et al., 2011; Jenkins & Mitchell, 2011; Ross & Olson, 2010; Wong et al., 2010; Zahn et al., 2007). Further variables of interest have comprised a word's number of letters, number of syllables, and its frequency (Jenkins & Mitchell, 2011; Simmons et al., 2010; Skipper et al., 2011; Zahn et al., 2007). Existing neuroimaging studies indicate that each of the factors listed above can influence neural activity during word processing, emphasising the need to consider them in well-designed experiments (e.g., Bedny & Thompson-Schill, 2006; Chee, Hon, Caplan, LingLee, & Goh, 2002; Citron, in press; Davis, Meunier, & Marslen-Wilson, 2004; Fliessbach, Weis, Klaver, Elger, & Weber, 2006; Hauk, Davis, & Pulvermüller, 2008; Kronbichler et al., 2004).

Importantly, the attempt to compare the processing of person relative to nonperson concepts poses another difficulty that goes beyond the matching of stimuli regarding their psycholinguistic and lexical properties. The new experimental approach defines person versus nonperson trials no longer based on a specific target (e.g., person vs. fruit). Rather, words are argued to differ inherently with regard to whether they capture a human or a nonhuman attribute. But how can researchers decide which words qualify as person concepts? To the best of our knowledge, existing word databases largely fail to provide this information. Various researchers have considered human concepts to be attributes that refer to mental states (e.g., *angry*, *focused*), given that humans compared to nonhuman entities are typically understood as causal agents with feelings, beliefs, and intentions (Gray, Gray, & Wegner, 2007). Further types of person knowledge that have been used in the literature (e.g., Heberlein & Saxe, 2005; Jenkins & Mitchell, 2010, 2011; Moran, Lee, & Gabrieli, 2011; Tsukiura, Suzuki, Shigemune, & Mochizuki-Kawai, 2008; Zaitchik et al., 2010) include words denoting personality traits (e.g., *idealistic*, *patient*) and items refering to a person's appearance (e.g., *blonde*, *chubby*).

Intriguingly, researchers have not only begun to differentiate various types of human concepts to delineate the admittedly ill-defined domain of person knowledge. By defining meaningful subtypes such as states, traits, and items of appearance, the respective functional contributions of different brain regions involved in the representation of person knowledge may also become better understood. Initial evidence indicates, for instance, that recruitment of the TPJ is particularly potent when person knowledge concerns the mental states (rather than the traits or the appearance) of others (e.g., Saxe, Schulz, & Jiang, 2006). To be able to contrast different subtypes of person knowledge, however, normative data on the temporal stability of human concepts need to be available for researchers to judge whether a concept refers to a transitory state or to an enduring attribute. In addition, concepts need to be quanitifiable according to whether they capture a visible attribute. Though initial piloting efforts along those lines have been made (e.g., Moran et al., 2010), systematic normative data are currently missing.

In summary, contemporary psychologists, cognitive scientists, and neuroscientists have become increasingly fascinated by the question whether person knowledge forms an important conceptual domain based upon which information is acquired, stored, and organized in the human brain. To be able to address these questions, researchers need to control for the psycholinguistic and lexical properties of person and nonperson concepts that could act as confounding variables and compromise experimental validity. Therefore, the present study developed a database of human and nonhuman words including their relevant psycholinguistic and lexical properties for research in experimental psychology and related disciplines.

Method

Participants

One hundred sixty native French speakers (80 men) aged between 18–27 years (mean age = 20.2 years) participated in this study. Participants chose to be compensated for their time by means of course credit or payment (€ 20.00).

Stimulus Material

Aiming to include a wide and relevant range of attributes, stimuli were adjectives selected from various French dictionaries as well as previous French rating studies (e.g., Boies, Lee, Ashton, Pascal, & Nicol, 2001; Gilet, Grühn, Studer, & Labouvie-Vief, 2012; Niedenthal et al., 2004). To ensure that participants were able to judge all target words in a 90 minute session, the final list of adjectives was limited to 875 items. This was done by eliminating adjectives that represented the negated version of already included targets (e.g., we kept *ordoné* but not *inordoné*) and by excluding adjectives that were applicable to humans and nonhuman entities alike (e.g., *simple*).

Procedure: Psycholinguistic Ratings

The study was advertised in the city of Louvain-La-Neuve (Belgium) through posters and flyers asking for students willing to spend 90 min on a word rating task. Volunteers were required to be native French speakers and between 18 and 30 years of age. Students interested in participating contacted the main experimenter (SQ) via e-mail to receive further information. Upon agreement to participate, individuals were free to come to the labouratory to complete the task (which applied to 48% of the sample) or to work from home. In both cases, participants were asked to complete the task in one sitting and received an Excel workbook (either presented on a lab computer or sent via e-mail) that contained two sheets. The first sheet gave general instructions (in French) about the task and stated:

> In this study, you will be asked to rate a series of words using an excel workbook. Importantly, we are interested in your personal opinion; there are no right or wrong answers in this task. You will receive a specific set of instructions about what to do and how to indicate your answers in the next worksheet. Please work at your own pace, but try to give your answers spontaneously (i.e., without overanalzying each item). If you happen to struggle with certain words, please try to find an answer nevertheless. You can, however, mark difficult items (see further instructions) to indicate your effort. If you encounter any words that you do not understand, please refrain from looking up their meaning but rather leave your reply blank. If you have any further questions, please do not hesitate to contact the experimenter.

A subsequent worksheet provided further instructions depending on which type of judgment a volunteer was asked to provide during task completion. We focused on eight judgments of theoretical interest. Table 1 lists these judgments, including the exact instructions participants received. Note that two of these judgments (i.e., *Can the attribute apply to a person?* and *Can the attribute apply to a nonhuman entity?*) asked participants to pro-

Table 1
Types of Psycholinguistic Judgments and Corresponding Instructions as Used in the Current Study

Dimension	Instructions [including Response Format]
Applicability to humans	Please indicate for each word whether it could be used to describe a human being (e.g., a person's personality, feelings, or appearance). [1 = *Yes* vs. 2 = *No*]
Applicability to nonhuman entitities	Please indicate for each word whether it could be used to describe the attributes, states, or the appearance of an object (such as clothes, food, furniture, vehicles etc.) or of a nonhuman entity (such as the weather). [1 = *Yes* vs. 2 = *No*]
Concreteness	Please evaluate each word according to whether it evokes a sensory experience. To do so, consider how easily each word evokes a specifc experience related to seeing, hearing, smelling, touching, or tasting. [1 = *does not evoke a sensory experience* to 7 = *easily evokes a sensory experience*]
Familiarity	Please evaluate your sense of familiarity with each word. To do so, please consider the extent to which you are in contact with or think about the concept that the word refers to in everyday life. [1 = *very unfamiliar* to 7 = *very familiar*]
Intensity	Please evaluate for each word the extremity of its meaning. To do so, consider the intensity of the concept the word refers to (e.g., one could think that *hot* is more extreme than *warm* and *freezing* more extreme than *cold*). [1 = *very moderate* to 7 = *very extreme*]
Temporal stability	Please indicate for each word whether it refers to a transitory state (i.e., a state that can change from one moment to the other) or to an enduring attribute (i.e., a characteristic that remains stable over time). [1 = *very transitory* to 7 = *very enduring*]
Valence	Please evaluate for each word whether it refers to something positive or negative. [1 = *very negative* to 7 = *very positive*]
Visibility	Please indicate for each word whether it refers to a characteristic that is directly visible or not. [1 = *not visible* to 7 = *easily visible*]

vide a categorical yes/no reply, whereas the remaining judgments (i.e., concreteness, familiarity, intensity, temporal stability, valence, visibility) requested ratings on a 7-point Likert scale. Participants were asked to enter their answers into the excel sheet by typing the corresponding number into a prespecified column next to each target.

They were further informed that an additional column allowed them to mark items that they found hard to judge by typing the number "9." These difficulty judgments were collected to learn whether some items were particularly challenging for raters to judge. Beyond these detailed instructions, the second worksheet asked participants to provide their age, gender, and the date before beginning the task. For each dimension of interest, ratings from 20 participants (10 men) were collected. Thus, participants were pseudorandomly assigned to one of the eight experimental conditions with participants' gender being taken into consideration. Although all participants were given the exact same list of words to judge, the order of items was uniquely randomized each time.

Procedure: Lexical Properties

To retrieve the words' lexical properties, the following steps were taken. First, each word's exact grammatical class, that is, whether it was an adjective (ADJ) and/or a past participle adjective (PPADJ) was determined by consulting Le Grand Robert (http://lerobert.demarque.com/fr/ca/dictionnaire-francais-en-ligne/grand-robert/), one of the largest French dictionaries available online. PPADJ are verb forms that can be used as adjectives. In English, an example of a PPADJ would be "a *focused* child," with the word *focused* being derived from the verb "to focus." In contrast, non-PPADJ adjectives do not represent a verb form, as is the case for the word *intelligent*. In a subsequent step, all words were looked up in the lexique3 corpus (http://www.lexique.org; New, Pallier, Ferrand, & Matos, 2001; version lexique3.71; retrieval of indices in March 2012) to determine their number of letters, number of syllables, as well as their frequency in movies (i.e., frequency per million words in the lexique corpus of film subtitles) and in books (i.e., frequency per million words in the lexique corpus of books).

Data Preprocessing

All completed worksheets were thoroughly reviewed to ensure data quality. Thus, for participants judging the words concerning their applicability to humans or to nonhuman entities, only replies consisting of the numbers "1" (*yes, can apply*) or "2" (*no, does not apply*) were considered valid. For the remaining dimensions, ratings ranging from 1 to 7 counted as adequate. Only data provided by participants with not more than five out-of-range answers (i.e., a number of unusual responses that could be attributed to typing errors) were included in subsequent analyses to ensure that instructions had been read and followed. As a result of this criterion, two participants were replaced. In addition, in line with previous work (e.g., Desrochers & Thompson, 2009), all data were screened for outlier values, that is, for ratings falling outside a $+2.5$ or -2.5 *SD* cutoff, within each item and judgment. Out-of-range replies ($<1\%$ of ratings per judgment) and outlier values ($<1.5\%$ of ratings per judgment) were discarded and not considered in subsequent analyses.

In a next step, the age profile of all eight participant groups was compared. The average age of each group ranged from 19.6 to 21.8 years and was equivalent across gender. Finally, workbooks were sorted alphabetically and the replies of all participants judging the same dimension of interest were collapsed in the following manner. First, for dimensions that required a binary yes/no response (i.e., applicability to humans, applicability to nonhumans), a frequency count for both answers was conducted. In contrast, for dimensions requesting a 7-point rating, the average of all obtained judgments was computed. Second, the number of valid replies for a specific item and the number of people marking an item as difficult was determined for all types of judgments.

The psycholinguistic data for each word were then merged with the retrieved lexical data. Importantly, for 34 adjectives (i.e., the items *adoré*, *alambiqué*, *amidonné*, *arboré*, *azoté*, *câchère*, *chauffé*, *chromé*, *congelable*, *crispé*, *déformable*, *déplié*, *dérouté*, *effiloché*, *émoustillé*, *empilable*, *empilé*, *enthousiasmé*, *façonné*, *flétri*, *imprimé*, *irrité*, *lessivable*, *nervuré*, *outragé*, *pr*éemballé, *rasé*, *rassuré*, *réutilisable*, *sécable*, *soupirant*, *surexcité*, *tempérant,* and *tricoté*) no entry was found in the Lexique3.71 corpus. A missing entry can signal one of two possibilities. Sometimes the word is not to be found in the corpus at all (i.e., it has not been used in any of the books or films included in the corpus; as was the case for the following 10 words: *azoté*, *câchère*, *congelable*, *déformable*, *empilable*, *lessivable*, *pr*éemballé, *réutilisable*, *sécable*, *tempérant*). Therefore, we put the frequencies of these words to zero in our database. Alternatively, it is also possible that a word can be found in the corpus (as was the case for the remaining items) but that its grammatical class is listed as a verb rather than as an adjective. In French, many identically spelled words can indeed be used as both verbs and adjectives. Thus, a missing entry as ADJ/PPADJ could imply that a given item was only used as a verb in the corpus.

In rare cases, however, computerized grammatical class tagging as incorporated in the lexique corpus can go wrong (Boris New, creator of lexique, personal communication, June 2012). Importantly, for a subset of this corpus, it is possible to check the context in which a word was counted. In consequence, for a limited set of examples, one can manually examine whether incorrect tagging has occurred. When making use of this opportunity, we noticed occasional mishaps. For instance, for the term *alambiqué*, adjective word frequencies were lacking. One context, however, in which the word was found in the corpus read: "[. . .] *selon votre dernière théorie, il semble que la ClA, le FBl, le Pentagone et la Maison-Blanche aient tramé un complot alambiqué pour le tuer*." Thus, in this specific context, the target should have been classified as an adjective. A similar case was observed for *chromé*, in which case the following sentence was found*: "Tes explications ne sont que foutaises en acier chromé*." Based on these observations, words that had frequency entries as verbs but not as adjectives were treated as missing values in subsequent analyses. Put differently, we refrained from putting their frequencies to zero since we could not be sure whether they were really not to be found as adjectives in the corpus or whether their grammatical class had instead been determined inaccurately.

Results

The results are arranged in four sections. First, we summarise the characteristics of the final database. Second, we examine the consistency of the obtained ratings. Third, we describe the associations between the different types of psycholinguistic and lexical properties obtained. Fourth, we explore how these properties differ for human relative to nonhuman attributes.

Characteristics of the Final Database

The final database can be downloaded from https://sites.google.com/site/thespringlab/materials. It consists of 875 French adjectives, listed in alphabetical order. To make the database more accessible for non-native French speakers, all adjectives are also translated in English and German (based on the Larousse online dictionaries, http://www.larousse.com). Because translations sometimes fail to capture an item's entire meaning, translated items should not be considered synonymous to their French counterparts but rather seen as approximations providing orientation when searching the database.

For each word the following lexical properties are listed: grammatical class (ppadj vs. adj), word length (number of letters, number of syllables), and word frequency (in films, in books). In addition, the following psycholinguistic properties are provided: applicability to humans, applicability to nonhumans, concreteness, familiarity, intensity, temporal stability, valence, and visibility. For psycholinguistic properties measured on a 7-point Likert scale, *SD*s are included. Furthermore, for each item and judgment, the number of valid responses as well as the number of people marking the word as difficult is listed. Difficulty frequencies are included in the database so that users can choose to limit word selection to items that raters felt comfortable judging. As depicted in Table 2, difficulty judgments differed depending on which psycholinguistic properties participants were asked to evaluate. While only 207 items got marked as difficult by at least one person during judgments of familiarity, 345 such items were recorded during concreteness judgments and 446 items when applicability to nonhuman entities was evaluated. The maximum number of people who marked the same item as difficult for a given judgment was 11 (55% of our sample).

Finally, all words in the database are tagged as belonging to one of five semantic categories based on the following criteria: Every item that was judged by at least 90% of participants to apply to humans and by not more than 10% of participants to apply to nonhuman entities is categorised as a primarily human attribute [for example, *altruiste* (altruistic), *anxieux* (anxious)]. Vice versa, every item that was judged by at least 90% of participants to apply to nonhuman entities and by not more than 10% of participants to apply to humans is categorised as a primarily nonhuman attribute [for example, *alcalin* (alkaline), *cassable* (breakable)]. Items qualified as attributes that equally apply to both humans and nonhuman entities when the numbers of participants stating that the item could be used to describe humans and nonhuman entities varied by not more than 10% across conditions [that is, an item that was marked as applicable to humans by 17 participants and as applicable to nonhumans by 15 participants was coded as equally applicable to both semantic categories; for example, *âgé* (old); *attractif* (attractive)]. Remaining items are differentiated in those that preferentially apply to humans [for example, *traditionaliste* (traditional), *prétentieux* (pretentious)] and those that preferentially apply to nonhuman entities [for example, *versatile* (versatile), *toxique* (toxic)] by identifying the maximum applicability frequencies for each of the two categories per word. The resulting five semantic categories can be ordered from primarily human (category 1) to primarily nonhuman (category 5). The present database contains 143 primarily human attributes, 390 preferentially human attributes, 51 attributes that are equally descriptive of human and nonhuman targets, 163 preferentially nonhuman attributes and 128 primarily nonhuman attributes.

Judgment Reliability

In line with previous work (e.g., Desrochers & Thompson, 2009; Gonthier, Desrochers, Thompson, & Landry, 2009), several reliability estimates were calculated to examine the internal consistency of the collected psycholinguistic ratings. Table 3 lists the average participant-sample correlation as well as Cronbach's alpha. To obtain the average participant-sample correlation, we computed the correlation between each participant's ratings and the mean ratings of the other participants for a given dimension of judgment. Note that these correlations fell consistently within a 2.5 *SD* range of the sample's mean correlation. Estimates as displayed in Table 3 signal medium to high stability of the collected ratings.

Similar results are obtained when indicators of external consistency are computed by comparing the present data with existing French word ratings studies (Bonin, Méot, Ferrand, & Roux, 2011;

Table 2
Frequency Counts of Items Marked as Difficult Across All Dimensions of Judgments

Number of people (max = 20)	Human	Nonhuman	CON	FAM	INT	TEM	VAL	VIS
1	146	232	243	138	147	233	220	218
2	54	98	70	39	81	77	92	96
3	26	56	21	15	47	47	51	33
4	17	30	8	7	29	19	17	26
5	15	16	1	5	25	12	9	9
6	7	5	2	1	15	7	1	8
7	4	3	0	1	7	2	0	1
8	3	1	0	1	3	2	0	6
9	2	2	0	0	2	0	0	0
10	1	2	0	0	0	0	0	0
11	1	1	0	0	0	0	0	0
Total	276	446	345	207	356	399	390	397

Note. CON = concreteness; FAM = familiarity; INT = intensity; TEM = temporal stability; VAL = valence; VIS = visibility.

Table 3
Estimates of Internal Consistency for Psycholinguistic Ratings

Psycholinguistic Property	CON	FAM	INT	TEM	VAL	VIS
Average participant–sample correlation	.42	.57	.49	.55	.84	.59
Cronbach's Alpha	.83	.91	.87	.91	.98	.93

Note. CON = concreteness; FAM = familiarity; INT = intensity; TEM = temporal stability; VAL = valence; VIS = visibility. To compute Cronbach's alpha for each dimension of judgment expected maximization (EM) imputation was used to replace missing or excluded values.

Gilet et al., 2012; Gonthier et al., 2009; Niedenthal et al., 2004; Table 4). Interstudy correlations revealed in particular high consistency for valence and familiarity ratings. For other dimensions of judgments, however, comparability was limited due to the uniqueness of our database. For instance, we failed to locate any previous French rating study that had asked participants to evaluate an attribute's visibility. Furthermore, though previous studies had asked participants to rate how easily each word evokes a mental image, only in the current study participants were requested to rate how easily each word evokes a specific experience related to seeing, hearing, smelling, touching, and/or tasting. Put differently, the obtained concreteness ratings comprised but were not limited to mental imagery. As could be expected based on such partial conceptual overlap, correlations between the present concreteness ratings and previous imagery ratings were found to be of medium strength (Table 4, column 3).

The lowest interstudy correlations were found for judgments of intensity and temporal stability. Note that the only study that had captured these constructs previously defined them in a slightly different manner as it only included words relating to emotional states (see Niedenthal et al., 2004). As a result of this focus, participants in this study rated temporal stability on a scale ranging from *seconds* to *hours*. In the current study, in contrast, temporal stability ratings were given on a scale ranging from *very transitory* to *very enduring* to capture transitory states as well as enduring attributes alike. In addition, in the study by Niedenthal and colleagues (2004) participants were asked to rate the intensity of each emotional state, while the current study inquired more generally after the intensity of the concept each word referred to. Despite these differences medium-size correlations across studies were observed across both dimensions.

Finally, we aimed to examine the consistency of judgments referring to an item's semantic category (i.e., whether it applied to humans and/or nonhuman entities) across studies. Unfortunately, to the best of our knowledge, the distinction between human and nonhuman attributes has not previously been investigated in a systematic manner. In the context of two existing French rating studies (Boies et al., 2001; Gilet et al., 2012), however, it has been argued that only such adjectives were selected from the French dictionary that captured human attributes. Of the 355 adjectives used by Boies and colleagues (2001), 184 were included in our database, most of which were found to be categorised as *primarily human* (61), *preferentially human* (116), or *equally applicable to human and nonhuman targets* (6), with only one item (i.e., *précieux*) falling in the category *preferentially nonhuman* according to our classification. Along similar lines, of the 835 adjectives used by Gilet and coworkers (2012), 344 were found in our database, most of which were categorised as *primarily human* (114), *preferentially human* (216), or *equally applicable to human and nonhuman targets* (12), with only two items (i.e., *emporté*, *inhibé*) falling in the category *preferentially nonhuman.*

In summary, despite slight conceptual differences across studies and regardless of the fact that previous data have been obtained in Canada (Boies et al., 2001; Gonthier et al., 2009); France (Bonin et al., 2011; Niedenthal et al., 2004) and Switzerland (Gilet et al., 2012) rather than in Belgium, the medium-to-high correlations seen across studies as well as the systematic semantic overlap with existing studies signal that the present data show adequate external consistency. At the same time, however, the attempt to compare our data with existing work emphasizes the originality and relevance of the current database.

Associations Between Psycholinguistic and Lexical Properties

Correlating the obtained psycholinguistic and lexical properties across all items revealed several effects of interest (Table 5). Not surprisingly, the two indicators of word length (i.e., number of letters and number of syllables) were highly associated, as were the two indicators of word frequency (i.e., word frequency in films and word frequency in books). In addition it was found that increases in word length were accompanied by decreases in word frequency as well as in concept concreteness and visibility. Moreover, increases in word frequency were accompanied by increases in concept familiarity. Also, as concreteness ratings increased, so did visibility ratings.

Furthermore, the more positive a concept was perceived to be, the more familiar it was to the reader and the less intense it was judged. For the latter two associations, however, regression models revealed that curvilinear relationships were more adequate to capture the associations (valence—familiarity: R^2 linear model = .09, R^2 curvilinear model = .27; valence—intensity: R^2 linear model = .21, R^2 curvilinear model = .34; both R^2 changes significant at $p < .01$). Thus, the more neutral a concept's valence, the less familiar and the less intense it was rated to be. Finally, in response to recent work showing that abstract words have a stronger emotional connotation than concrete words (Kousta, Vigliocco, Vinson, Andrews, & Del Campo, 2011), we further scrutinized the association between valence and ratings of concreteness. Neither a significant correlation, $r(873) = .03$, $p = .32$, nor a curvilinear relationship, $R^2 = .001$, $p = .94$, was observed.

Table 4
Interstudy Correlations Across Selected Dimensions of Interest

Study	Items in common	CON	FAM	INT	TEM	VAL
Bonin et al., 2011	45	.65*	—	—	—	—
Gilet et al., 2012	344	.62*	—	—	—	.93*
Gonthier et al., 2009	46	.64*	—	—	—	—
Niedenthal et al., 2004	36	—	.76*	.51*	.47*	.96*

Note. CON = concreteness; FAM = familiarity; INT = intensity; TEM = temporal stability; VAL = valence; VIS = visibility.
* Correlations significant at 0.01 level (2-tailed).

Table 5
Interitem Correlations for Lexical and Psycholinguistic Properties

	NoL	NoS	FF	BF	CON	FAM	INT	TEM	VAL	VIS
NoL	1	.69*	−.16*	−.17*	−.13*	−.08	.07	.07	.11*	−.23*
NoS		1	−.21*	−.23*	−.14*	−.08	.12*	−.07	.04	−.21*
FF			1	.92*	.07	.29*	−.08	.03	.10	.11*
BF				1	.10	.24*	−.07	.04	.06	.16*
CON					1	.17*	−.11*	.10	.03	.64*
FAM						1	−.05	−.01	.30*	−.03
INT							1	−.15*	−.46*	−.16*
TEM								1	.18*	.04
VAL									1	−.08
VIS										1

Note. NoL = number of letters; NoS = number of syllables; FF = word frequency in films; FB = word frequency in books; CON = concreteness; FAM = familiarity; INT = intensity; TEM = temporal stability; VAL = valence; VIS = visibility.
* Correlations significant at 0.001 level (2-tailed).

Comparison of Human and Nonhuman Attributes

In a final step of analyses, the five established semantic categories were compared with regard to their lexical and psycholinguistic properties through a series of one-way analyses of variance (ANOVAs; Table 6). To account for the fact that violations of the assumption of homogeneity of variance can have serious consequences when comparing groups of unequal sizes (as was the case in our data), we report the Welch *F*-ratio for our effects, which has been found to be robust toward inhomogeneity of variances under such conditions (as recommended by Field, 2005). In addition, for each ANOVA, we computed polynomial contrasts to examine the data for linear or quadratic trends.

It was found that items in the five different semantic categories did not differ systematically on word length or valence. Significant differences were, however, observed for the remaining word properties. Specifically, quadratic trends indicated that items with limited applicability (i.e., those that primarily or preferentially applied to only humans or nonhuman entities) were used less frequently than items that captured qualities of both semantic categories, film frequency, $F(1, 846) = 32.88$, $p < .01$; book frequency, $F(1, 846) = 38.30$, $p < .01$. Additional linear trends revealed that as concept applicability to nonhuman entities increased, so did concreteness, $F(1, 870) = 116.10$, $p < .01$; temporal stability, $F(1, 870) = 78.99$, $p < .01$; and visibility ratings, $F(1, 870) = 116.28$, $p < .01$. In contrast, as concept applicability to nonhuman entities decreased, intensity, $F(1, 870) = 131.02$, $p < .01$, and familiarity ratings, $F(1, 870) = 142.64$, $p < .01$, increased.

Finally, we attended again to the relationship between concreteness and valence ratings (see Kousta et al., 2011). When this relationship was investigated separately for the two semantic categories of interest (i.e., for words that applied primarily or preferentially to humans vs. for words that applied primarily or preferentially to nonhuman entities), the predicted curvilinear relationship emerged for the latter ($R^2 = .07$, $p < .01$) but not the former ($R^2 = .004$, $p = .15$).

Discussion

The processing of human and nonhuman concepts during basic comprehension and reasoning tasks has become a recent topic of inquiry. To help researchers select adequate stimuli for these studies, the current investigation obtained pivotal lexical and psycholinguistic properties for a wide range of human and/or nonhuman attributes. Examining the relatedness of these attributes regardless of semantic category revealed several effects, including some previously reported in the literature. For instance, increases in word frequency were accompanied by decreases in word length (see Piantadosi, Tily, & Gibson, 2011; Schröder, Gemballa,

Table 6
*Mean Values of Lexical and Psycholinguistic Properties Across Semantic Categories (*SDs *Provided in Parentheses)*

Applicability	Human	Mainly human	Both	Mainly nonhuman	Nonhuman	*F*
Lexical properties						
Number of letters	7.98 (2.01)	7.68 (2.12)	7.45 (2.54)	7.60 (2.02)	7.75 (2.18)	.91
Number of syllables	2.76 (.70)	2.61 (.79)	2.53 (.92)	2.55 (.73)	2.63 (.69)	2.01
Film frequency	5.93 (20.29)	6.95 (21.61)	35.89 (103.68)	1.87 (7.43)	.72 (1.69)	11.96*
Book frequency	5.38 (12.52)	7.42 (24.57)	44.76 (128.17)	4.41 (12.84)	2.20 (4.38)	7.07*
Psycholinguistic properties						
Concreteness	3.38 (0.52)	3.42 (0.62)	3.74 (0.85)	3.84 (0.84)	4.13 (0.76)	32.15*
Familiarity	5.29 (0.71)	4.93 (0.91)	4.77 (1.13)	4.23 (1.01)	4.22 (0.88)	45.11*
Intensity	4.38 (0.72)	4.24 (0.67)	4.15 (0.74)	3.97 (0.69)	3.51 (0.56)	45.95*
Temporal Stability	4.20 (1.10)	4.37 (0.86)	4.50 (0.83)	4.54 (0.74)	5.11 (0.67)	30.13*
Valence	3.71 (1.64)	3.88 (1.48)	3.74 (1.32)	3.76 (1.04)	3.88 (0.86)	.64
Visibility	3.58 (0.74)	3.83 (1.14)	4.31 (1.41)	4.40 (1.18)	4.86 (1.16)	36.27*

* *F*-ratio significant at 0.01 level.

Ruppin, & Wartenburger, 2011; Zipf, 1935) and by increases in concept familiarity (see Schröder et al., 2011). In addition, it was found that increases in word length were accompanied by decreases in visibility—an effect that may resemble observations of increases in word length being associated with decreases in imageability (e.g., Marques, Morais, & Pinto, 2007). Furthermore, curvilinear associations between concept valence and familiarity as well as intensity were observed in the current data.

It is interesting that a curvilinear relationship has also recently been argued to link valence and concreteness ratings. Specifically, it has been claimed that "abstract words are more emotionally valenced than are concrete words" (Kousta et al., 2011, p. 14). Contrary to this claim, no evidence in support of this assumption was found in the current study when all words were considered at once. However, when the relationship between concreteness and valence ratings was investigated separately for concepts that applied to humans versus for concepts that applied to nonhuman entities, the predicted curvilinear relationship emerged for the latter. Therefore, our data may indicate that enhanced emotional valence particularly characterizes the representation of abstract words that refer to nonhuman attributes. Further research is necessary to examine whether this observation signals a reliable pattern of association.

The current study also suggests that human and nonhuman attributes may be characterised by systematic psycholinguistic differences. On the one hand, attributes primarily or preferentially used to describe humans are considered more familiar and intense than nonhuman attributes. On the other hand, attributes primarily or preferentially used to describe nonhuman entities tend to be more concrete, visible, and more enduring than human attributes. These data support previous observations according to which concreteness and imageability values were reduced for human compared to nonhuman concepts (for which the researchers controlled statistically, see Ross & Olson, 2010; Skipper et al., 2011; Zahn et al., 2009, 2007). Together, these findings emphasise that comparing the processing of human and nonhuman concepts requires the careful consideration of their psycholinguistic properties. The current database enables researchers to do so by providing the necessary indices to select well-matched items or to statistically control for emerging differences.

Moreover, the temporal stability and visibility ratings included in the current database allow scientists to differentiate between pivotal subtypes of person knowledge such as mental/emotional states, human traits, and human appearances (see Heberlein & Saxe, 2005; Jenkins & Mitchell, 2011; Moran et al., 2010). Distinguishing between these different types of person knowledge is of particular importance for the field. According to contemporary theories of knowledge representation, the organisation of concepts in the human mind/brain may not only be constrained by domain (e.g., person vs. object knowledge) but also by sensory modality (see Mahon & Caramazza, 2009). Put differently, concepts are thought to be tied to the sensorimotor basis on which their learning was based (e.g., Barsalou, 2008). As a result, accessing the meaning of a specific concept is expected to recreate—at least partially—the original learning experience. Therefore, understanding the organisation of person knowledge at greater depth will require distinguishing between concepts that diverge in their acquisition history, as can be expected to be the case for items of appearance, states, and traits.

Beyond the database's strengths, one potential limitation also deserves consideration. Several previous studies interested in the processing of person relative to nonperson knowledge included living nonhuman entities such as animals and their attributes as targets of comparison (e.g., Mason et al., 2004; Zahn et al., 2007). In the current study, we asked participants to judge the concepts' applicability to humans or inanimate nonhuman entities such as objects or the weather. We intentionally refrained from including animals as targets given that they are frequently anthropomorphized by humans (see Horowitz & Bekoff, 2007; Keeley, 2004). Therefore, concepts that are typically used to describe the mental state, appearance, and/or character of other people might also apply to describe the mental state, appearance, and/or character of animals (see Demoulin et al., 2004).

In summary, the current study presents the first substantial French database of human and/or nonhuman attributes, providing their concreteness, familiarity, intensity, temporal stability, valence, visibility, word length, word frequency, and grammatical class. This comprehensive database can be used by researchers from different disciplines to consider pivotal psycholinguistic and lexical properties when selecting human and nonhuman stimuli for future research.

Résumé

Le traitement des concepts humains et non humains (par ex., *agréable vs comestible*) durant des tâches de compréhension et de raisonnement de base est devenu un sujet de grand intérêt pour la recherche scientifique. Pour veiller à ce que les effets expérimentaux découlant de cette recherche reflètent la distinction sémantique hypothétique, il faut prendre en compte les éventuelles variables confusionnelles, comme des attributs psycholinguistiques ou lexicaux des stimuli exacts qui ont été choisis. Dans la présente étude, des données normatives de tels attributs ont été obtenues pour un ensemble de 875 adjectifs en français, en demandant à 8 groupes de 20 participants d'évaluer chacun des mots pour une dimension d'intérêt théorique. Les évaluations recueillies indiquent dans quelle mesure chacun des adjectifs évoque une expérience sensorielle (concrétude), décrit un attribut permanent (stabilité temporelle), renvoie à une caractéristique visible (facilité d'observation), dénote un concept neutre ou teinté d'affectivité (valence), décrit un attribut de faible ou de forte intensité, est familier au lecteur et peut être utilisé pour décrire des personnes ou des éléments inanimés, comme des objets. En outre, pour chaque adjectif, on a déterminé sa classe grammaticale (adjectif qualifiant vs adjectif participe), sa longueur (nombre de lettres et de syllabes), et sa fréquence a été trouvé dans le Lexique 3. La base de données qui en résulte permettra aux chercheurs de tenir compte d'attributs psycholinguistiques et lexicaux déterminants lorsqu'ils choisissent des stimuli humains et non humains dans le cadre de leurs recherches.

Mots-clés : état des connaissances, concepts sociaux, connaissance des traits, évaluation des mots.

References

Adolphs, R. (2009). The social brain: Neural basis of social knowledge. *Annual Review of Psychology, 60,* 693–716. doi:10.1146/annurev.psych.60.110707.163514

Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology, 59,* 617–645. doi:10.1146/annurev.psych.59.103006.093639

Bedny, M., & Thompson-Schill, S. L. (2006). Neuroanatomically separable effects of imageability and grammatical class during single-word comprehension. *Brain & Language, 98,* 127–139. doi:10.1016/j.bandl.2006.04.008

Boies, K., Lee, K., Ashton, M. C., Pascal, S., & Nicol, A. A. M. (2001). The structure of the french personality lexicon. *European Journal of Personality, 15,* 277–295. doi:10.1002/per.411

Bonin, R., Méot, A., Ferrand, L., & Roux, S. (2011). L'imageabilité et relations avec d'autres variables psycholinguistiques. *L'année psychologique, 111,* 327–357. doi:10.4074/S0003503311002041

Capitani, E., Laiacona, M., Mahon, B., & Caramazza, A. (2003). What are the facts of category-specific deficits? A critical review of the clinical evidence. evidence. *Cognitive Neuropsychology, 20,* 213–261. doi:10.1080/02643290244000266

Caramazza, A., & Shelton, J. R. (1998). Domain specific knowledge systems in the brain: The animate-inanimate distinction. *Journal of Cognitive Neuroscience, 10,* 1–34. doi:10.1162/089892998563752

Chee, M. W. L., Hon, N. H. H., Caplan, D., Ling Lee, H., & Goh, J. (2002). Frequency of concrete words modulates prefrontal activation during semantic judgments. *NeuroImage, 16,* 259–268. doi:10.1006/nimg.2002.1061

Citron, F. M. M. (in press). Neural correlates of written emotion word processing: A review of recent electrophysiological and hemodynamic neuroimaging studies. *Brain and Language*.

Contreras, J. M., Banaji, M. R., & Mitchell, J. P. (2011). Dissociable neural correlates of steretoypes and other forms of semantic knowledge. *Social Cognitive and Affective Neuroscience*. doi:10.1093/scan/nsr053

Davis, M. H., Meunier, F., & Marslen-Wilson, W. D. (2004). Neural responses to morphological, syntactic, and semantic properties of single words: An fMRI study. *Brain and Language, 89,* 439–449. doi:10.1016/S0093-934X(03)00471-1

Demoulin, S., Leyens, J. P., Paladino, M. P., Rodriguez, R. T., Rodriguez, A. P., & Dovidio, J. F. (2004). Dimensions of "uniquely" human and "nonuniquely" human emotions. *Cognition and Emotion, 18,* 71–96. doi:10.1080/02699930244000444

Desrochers, A., & Thompson, G. L. (2009). Subjective frequency and imageability ratings for 3600 French nouns. *Behavior Research Methods, 41,* 546–557. doi:10.3758/BRM.41.2.546

Ellis, A. W., Young, A. W., & Critchley, A. M. R. (1989). Loss of memory for people following temporal lobe damage. *Brain, 112,* 1469–1483. doi:10.1093/brain/112.6.1469

Epley, N., Waytz, A., & Cacioppo, J. T. (2007). On seeing human: A three-factor theory of anthropomorphism. *Psychological Review, 114,* 864–886. doi:10.1037/0033-295X.114.4.864

Field, A. (2005). *Discovering statistics using SPSS* (2nd ed.). London, United Kingdom: Sage.

Fiske, S. T., & Neuberg, S. L. (1990). A continuum of impression formation, from categorybased to individuating processes: Influences of information and motivation on attention and interpretation. *Advances in Experimental Social Psychology, 23,* 1–74. doi:10.1016/S0065-2601(08)60317-2

Fletcher, P. C., & Frith, C. D. (2009). Perceiving is believing: A Bayesian approach to explaining the positive symptoms of schizophrenia. *Nature Reviews Neuroscience, 10,* 48–58. doi:10.1038/nrn2536

Fliessbach, K., Weis, S., Klaver, P., Elger, C. E., & Weber, B. (2006). The effect of word concreteness on recognition memory. *NeuroImage, 32,* 1413–1421. doi:10.1016/j.neuroimage.2006.06.007

Gilbert, S. J., Meuwese, J. D. I., Towgood, K. J., Frith, C. D., & Burgess, P. W. (2009). Abnormal functional specialization within medial prefrontal cortex in high-functioning autism: A multi-voxel similarity analysis. *Brain, 132,* 869–878. doi:10.1093/brain/awn365

Gilet, A-L., Grühn, D., Studer, J., & Labouvie-Vief, G. (2012). Valence, arousal, and imagery ratings for 835 French attributes by young, middle-aged, and older adults: The French Emotional Evaluation List (FEEL). *Revue européenne de psychologie appliquée, 62,* 173–181.

Gonthier, I., Desrochers, A., Thompson, G., & Landry, D. (2009). Normes d'imagerie et de fréquence subjective pour 1760 mots monosyllabique de la langue française. *Canadian Journal of Experimental Psychology, 63,* 139–149. doi:10.1037/a0015386

Gray, H. M., Gray, K., & Wegner, D. M. (2007). Dimensions of mind perception. *Science, 315,* 619. doi:10.1126/science.1134475

Hauk, O., Davis, M. H., & Pulvermueller, F. (2008). Modulation of brain activity by multiple lexical and word form variables in visual word recognition: A parametric fMRI study. *NeuroImage, 42,* 1185–1195. doi:10.1016/j.neuroimage.2008.05.054

Heberlein, A. S., & Saxe, R. R. (2005). Dissociation between emotion and personality judgments: Convergent evidence from functional neuroimaging. *NeuroImage, 28,* 770–777. doi:10.1016/j.neuroimage.2005.06.064

Heider, F., & Simmel, M. (1944). An experimental study of apparent behavior. *The American Journal of Psychology, 57,* 243–259. doi:10.2307/1416950

Horowitz, A. C., & Bekoff, M. (2007). Naturalizing anthropomorphism: Behavioral prompts to our humanizing of animals. *Anthrozoos, 20,* 23–35. doi:10.2752/089279307780216650

Humphreys, G. W., & Forde, E. M. E. (2001). Hierarchies, similarity, and interactivity in object recognition: Category-specific neuropsychological deficits. *Behavioral and Brain Sciences, 24,* 450–500.

Jenkins, A. C., & Mitchell, J. P. (2010). Mentalizing under uncertainty: Dissociated neural responses to ambiguous and unambiguous mental state inferences. *Cerebral Cortex, 20,* 404–410. doi:10.1093/cercor/bhp109

Jenkins, A. C., & Mitchell, J. P. (2011). Medial prefrontal cortex subserves diverse forms of self-reflection. *Social Neuroscience, 6,* 211–218. doi:10.1080/17470919.2010.507948

Keeley, B. L. (2004). Anthropomorphism, primatomorphism, mammalomorphism: Understanding cross-species comparisons. *Biology and Philosophy, 19,* 521–540. doi:10.1007/sBIPH-004-0540-4

Kousta, S.-T.,Vigliocco, G., Vinson, D. P., Andrews, M., & Del Campo, E. (2011). The representation of abstract words: Why emotion matters. *Journal of Experimental Psychology: General, 140,* 14–34. doi:10.1037/a0021446

Kronbichler, M., Hutzler, F., Wimmer, H., Mair, A., Staffen, W., & Ladurner, G. (2004). The visual word form area and the frequency with which words are encountered. *NeuroImage, 21,* 946–953. doi:10.1016/j.neuroimage.2003.10.021

Lambert, N. A., Swain, M. A., Miller, L. A., & Caine, D. (2006). Exploring the neural organization of person-related knowledge: Lateralization of lesion, category specificity, and stimulus modality effects. *Neuropsychology, 20,* 346–354. doi:10.1037/0894-4105.20.3.346

Mahon, B. Z., & Caramazza, A. (2009). Concepts and categories: A cognitive neuropsychological perspective. *Annual Review of Psychology, 60,* 27–51. doi:10.1146/annurev.psych.60.110707.163532

Marques, J. F., Fonseca, F. L., Morais, S., & Pinto, I. A. (2007). Estimaged age of acquisition norms for 834 Portuguese nouns and their relation with other psycholinguistic variables. *Behavior Research Methods, 39,* 439–444. doi:10.3758/BF03193013

Martin, A. (2007). The representation of object concepts in the brain. *Annual Review of Psychology, 58,* 25–45. doi:10.1146/annurev.psych.57.102904.190143

Mason, M. F., Banfield, J. F., & Macrae, C. N. (2004). Thinking about actions: The neural substrates of person knowledge. *Cerebral Cortex, 14,* 209–214. doi:10.1093/cercor/bhg120

Miceli, G., Capasso, R., Daniele, A., Esposito, T., Magarelli, M., & Tomaiuolo, F. (2000). Selective deficit for people's names following left temporal damage: An impairment of domain-specific conceptual knowledge. *Cognitive Neuropsychology, 17,* 489–516. doi:10.1080/02643290050110629

Mitchell, J. P., Banaji, M. R., & Macrae, C. N. (2005). General and specific contributions of the medial prefrontal cortex to knowledge about mental states. *NeuroImage, 28,* 757–762. doi:10.1016/j.neuroimage.2005.03.011

Mitchell, J. P., Heatherton, T. F., & Macrae, C. N. (2002). Distinct neural systems subserve person and object knowledge. *Proceedings of the National Academy of Sciences of the United States of America, 99,* 15238–15243. doi:10.1073/pnas.232395699

Moran, J. M., Lee, S. M., & Gabrieli, J. D. E. (2011). Dissociable neural systems supporting knowledge about human character appearance in ourselves and others. *Journal of Cognitive Neuroscience, 23,* 2222–2230. doi:10.1162/jocn.2010.21580

New, B., Pallier, C., Ferrand, L., & Matos, R. (2001). Une base de données lexicales du français contemporain sur internet: LEXIQUE, *L'Année Psychologique, 101,* 447–462. doi:10.3406/psy.2001.1341

Niedenthal, P., Auxiette, C., Nugier, A., Dalle, N., Bonin, P., & Fayol, M. (2004). A prototype analysis of the French category "emotion". *Cognition and Emotion, 18,* 289–312. doi:10.1080/02699930341000086

Piantadosi, S. T., Tily, H., & Gibson, E. (2011). Word lengths are optimized for efficient communication. *Proceedings of the National Academy of Sciences of the United States of America, 108,* 3526–3529. doi:10.1073/pnas.1012551108

Premack, D. G., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1,* 515–526. doi:10.1017/S0140525X00076512

Quadflieg, S., & Macrae, C. N. (2012). Stereotypes and stereotyping: What's the brain got to do with it? *Review of Social Psychology, 22,* 215–273. doi:10.1080/10463283.2011.627998

Ross, L. A., & Olson, I. R. (2010). Social cognition and the anterior temporal lobes. *NeuroImage, 49,* 3452–3462. doi:10.1016/j.neuroimage.2009.11.012

Samson, D., & Apperly, I. A. (2010). There is more to mind reading than having theory of mind concepts: New directions in theory of mind research. *Infant and Child Development, 19,* 443–454.

Saxe, R., Schulz, L. E., & Jiang, Y. V. (2006). Reading minds versus following rules: Dissociating theory of mind and executive control in the brain. *Social Neuroscience, 1,* 284–298. doi:10.1080/17470910601000446

Schröder, A., Gemballa, T., Ruppin, S., & Wartenburger, I. (2011). German norms for semantic typicality, age of acquisition, and concept familiarity. *Behavior Research Methods, 44,* 380–394. doi:10.3758/s13428-011-0164-y

Simmons, W. K., & Martin, A. (2009). The anterior temporal lobes and the functional architecture of semantic memory. *Journal of the International Neuropsychological Society, 15,* 645–649. doi:10.1017/S1355617709990348

Simmons, W. K., Reddish, M., Bellgowan, P. S. F., & Martin, A. (2010). The selectivity and functional connectivity of the anterior temporal lobes. *Cerebral Cortex, 20,* 813–825. doi:10.1093/cercor/bhp149

Skipper, L. M., Ross, L. A., & Olson, I. R. (2011). Sensory and semantic category subdivisions within the anterior temporal lobesl. *Neuropsychologica, 49,* 3419–3429. doi:10.1016/j.neuropsychologia.2011.07.033

Tsukiura, T., Suzuki, C., Shigemune, Y., & Mochizuki-Kawai, H. (2008). Differential contributions of the anterior temporal and medial temporal lobe to the retrieval of memory for person identity information. *Human Brain Mapping, 29,* 1343–1354. doi:10.1002/hbm.20469

Tyler, L. K., & Moss, H. E. (2001). Towards a distributed account of conceptual knowledge. *Trends in Cognitive Sciences, 5,* 244–252. doi:10.1016/S1364-6613(00)01651-X

Van Overwalle, F. (2011). A dissociation between social mentalizing and general reasoning. *NeuroImage, 54,* 1589–1599. doi:10.1016/j.neuroimage.2010.09.043

Warrington, E. K., & Shallice, T. (1984). Category specific semantic impairment. *Brain, 107,* 829–853. doi:10.1093/brain/107.3.829

Wong, C. L., Harris, J. A., & Gallate, J. E. (2012). Evidence for a social function of the anterior temporal lobes: Low-frequency rTMS reduces implicit gender stereotypes. *Social Neuroscience, 7,* 90–104. doi:10.1080/17470919.2011.582145

Zahn, R., Moll, J., Iyengar, V., Huey, E. D., Tierney, M., Krueger, F., & Grafman, J. (2009). Social conceptual impairments in frontotemporal lobar degeneration with right anterior temporal hypometabolism. *Brain: A Journal of Neurology, 132,* 604–616. doi:10.1093/brain/awn343

Zahn, R., Moll, J., Krueger, F., Huey, E. D., Garrido, G., & Grafman, J. (2007). Social concepts are represented in the superior anterior temporal cortex. *Proceedings of the National Academy of Sciences of the United States of America, 104,* 6430–6435. doi:10.1073/pnas.0607061104

Zaitchik, D., Walker, C., Miller, S., LaViolette, P., Feczko, E., & Dickerson, B. C. (2010). Mental state attribution and the temporoparietal junction: An fMRI study comparing belief, emotion, and perception. *Neuropsychologia, 48,* 2528–2536. doi:10.1016/j.neuropsychologia.2010.04.031

Zipf, G. K. (1935). *The psycho-biology of language*. Cambridge, MA: MIT Press.

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