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Psycholinguistic norms for 320 fixed expressions (idioms and proverbs) in French

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Abstract

We provide psycholinguistic norms for a new set of 160 French idiomatic expressions and 160 proverbs: knowledge, predictability, literality, compositionality, subjective and objective frequency, familiarity, age of acquisition (AoA) and length. Different analyses (reliability, descriptive statistics and correlations) performed on the norms are reported and discussed. The norms can be downloaded as Supplemental Material.

Keywords

Idioms; proverbs; psycholinguistic norms

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Hello Sandra, I am just back from a meeting. Thomas was there and, you know, he was *all at sea.*

Well, he has been working hard these last days and *All work and no play makes Jack a dull boy.*

As this dialogue illustrates, idioms and proverbs are fixed expressions that are pervasive in everyday conversations, with about six (non-literal) fixed expressions occurring per minute of discourse as claimed by Cacciari (2014). However, they are often difficult to understand when learning a foreign language. Idioms can be broadly defined as multiword expressions whose meaning cannot be inferred from the meaning of their single, constituting words; they are "[. . .] phrases that are more than the sum of their parts" (Nordmann & Jambazova, 2017). Indeed, they convey a meaning—figurative meaning—that varies to some extent from the literal meaning assigned to the words, i.e., degree of *decomposability* (or semantic transparency; Cacciari, 2014). To illustrate, and as indicated in Bonin, Méot, and Bugaiska's (2013) norms, the French expression *Etre lent comme une tortue*, which literally means to be as slow as a tortoise, is a highly decomposable idiomatic expression because the different parts (être [to be], lent [slow], comme une tortue [as a tortoise]) of the idioms contribute to its meaning. By contrast, *Se faire des cheveux*, meaning to worry, is a weakly decomposable idiom because the different parts (se faire [to make] des cheveux [some hair]) of the idiom contribute very little to the (figurative) meaning (to worry).

The literal interpretation of idioms can be more or less semantically plausible. For example, the idiom *jeter l'argent par les fenêtres* which literally means "to throw money out of the window" and figuratively means "to spend lavishly" describes a literal event that can actually happen, as one can literally throw money out of the window, and is therefore ambiguous in French. Proverbs are not necessarily figurative expressions as they can also be literal expressions. Proverbs are usually defined as a part of folk wisdom (Benjafield, Frommhold, Keenan, Muckenheim, & Mueller, 1993), expressing well-know truths, social norms or moral concerns (Gibbs & Beitel, 1995), and one critical difference between idioms and proverbs is that the latter are full sentences, and are

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generally true statements, both literally and figuratively (Cacciari, 2014; Ferretti, Schwint, & Katz, 2007). To give an example, the proverb *Rome wasn't built in a day* is literally true because Rome is a city which took a long time to build, and figuratively, it is also true that it takes a long time to do an important job. In contrast, the French idiom *il ne faut pas avoir les yeux plus gros que le ventre*, which means *one should bite off only as much as one can chew*, cannot be literally true since it is not possibly true to have "eyes" bigger than one's "stomach." Even though there are differences between idioms and proverbs, as claimed by Nordmann, Cleland, and Bull (2013), they are "*[. . .] part of the same spectrum of fixed expressions"* (p. 1562).

Idioms and proverbs can be more or less familiar. Indeed, the familiarity of idiomatic expressions has been defined and measured in many different ways in the literature. Here, we have adopted the definition of familiarity provided by Tabossi, Arduino, and Fanari (2011), that is to say whether a given proverb or idiom is known by many or only a few people. This specific measure helps establish the degree of familiarity of each idiom relative to other idioms (Tabossi et al., 2011), and it may be thought of as a subjective measure of the "popularity" of fixed expressions.[1] However, familiarity can further be distinguished from *subjective frequency* which is an evaluation of the frequency with which participants think they have read, heard or produced an idiom or a proverb (e.g., Benjafield et al., 1993; Libben & Titone, 2008 used the term "familiarity" for this type of rating). This latter measure is consistent with the subjective frequency measure used to gauge the frequency of encounter of individual words (e.g., Ferrand et al., 2008). In the Bonin et al. (2013) study, both familiarity and subjective frequency were reliable determinants of idiom comprehension times, suggesting that the two variables are able to index different aspects of a common construct. Thus, it is important to take both measures into account.

Age of acquisition (AoA) is one of the most frequent measures of individual words for which norms have been provided and continue to be collected, especially subjective AoA norms collected in adults (e.g., Göz, Tekcan, & Erciyes, 2016 for a recent collection of AoA norms in Turkish). AoA and word frequency (objective and subjective frequency measures) for individual words are correlated variables, with the result that one variable needs to be controlled for when investigating the influence of the other. Moreover, AoA is an important determinant of performance in a wide variety of lexical processing tasks (for reviews, see Johnston & Barry, 2006; Juhasz, 2005), with early acquired words being processed faster and more accurately than late acquired words. However, as far as idiomatic expressions are concerned, this type of measure has not been taken into account in normative studies, if we accept the studies of Tabossi et al. (2011) and Bonin et al. (2013). Perhaps, AoA was not considered in previous studies on idioms because researchers have thought that idioms are mostly acquired quite late in life. If this were indeed the case, collecting AoA norms on idioms would not be very helpful. However, whether or not idioms and proverbs can be acquired early in life is an issue that has to be assessed empirically. Subjective AoA norms are generally obtained using Likert scales. Likewise, participants are required to estimate the age at which they think they learned each word in its written or oral form, with age bands corresponding to the different values of the scale, e.g., 0-3 at one extreme and 12+ at the other. This procedure was used in Bonin et al.'s (2013) normative study on idioms. Given that AoA effects have been claimed to be stronger in tasks that mainly rely on lexical-semantic codes (e.g., spoken or written naming) than in task that rely less on semantic codes (e.g., reading aloud or spelling to dictation; see Bonin, Barry, Méot, & Chalard, 2004 and Mermillod, Bonin, Méot, Ferrand, & Paindavoine, 2012 for an in-depth theoretical analysis), the AoA variable should play a role in the processing of fixed expressions. Indeed, and to our knowledge, Bonin et al. (2013) were the first to report that AoA was a reliable predictor of the time taken to read idioms to oneself. Thus, even though AoA norms are not often collected for fixed expressions, this variable is actually a very important one that should be taken into account when investigating the processing of idioms. To our knowledge, AoA norms have not been collected for proverbs and it will be important for the future work to assess whether, and to what extent, AoA plays a role in the processing of proverbs. Finally, having AoA norms for idiomatic expressions (and proverbs) is also useful when designing experiments on idiom processing in children (e.g., Caillies & Le Sourn-Bissaoui, 2008). As said earlier, although idioms are generally thought to be acquired rather late in life, certain idioms may be acquired somewhat earlier, and subjective AoA norms should help identify which are acquired early and what their characteristics are, and which are acquired later together with their associated characteristics.

There are a substantial number of studies providing different types of psycholinguistic norms for different types of stimuli (e.g., pictures of objects, of actions, photographs of celebrities), but only a few studies have collected norms for figurative expressions. Indeed, norms for idiomatic expressions are available in Italian (Tabossi et al., 2011), in English (e.g., Cronk, Lima, & Schweigert, 1993; Libben & Titone, 2008; Nordmann et al., 2013, 2014; Titone & Connine, 1994), in German (Citron et al., 2016), in Bulgarian (Nordmann & Jambazova, 2017), in Chinese (Li, Zhang, & Wang, 2016) and in French (Bonin et al., 2013; Caillies, 2009). To our knowledge, there are no psycholinguistic norms for proverbs in French and only a few studies have collected norms on proverbs in English (e.g., Benjafield et al., 1993; Higbee & Millard, 1983).

Norms on idioms are very useful because they help us gain a better understanding of how they are processed (see Cacciari, 2014, for an overview). In effect, norms make it possible to address several theoretical issues related to their comprehension (e.g., Tabossi, Fanari, & Wolf, 2009) and to their verbal production (e.g., Cutting & Bock, 1997; Konopka & Bock, 2009; Nordmann et al., 2013; Sprenger, Levelt, & Kempen, 2006). To illustrate, we will take the case of the comprehension of idioms. One critical issue has been to evaluate the degree to which literal aspects of idioms are activated and processed during their online comprehension. Different views on idiom comprehension have been put forward in the literature and these vary as a function of the role they assign to the processing of literal meaning when computing figurative meanings. At one extreme, it has been assumed that idioms are just long words that are directly mapped to their figurative meanings, and that they are therefore understood as whole chunks (Swinney & Cutler, 1979). Other views assume that the processing of literal aspects of idioms plays a more or less important role. Likewise, according to hybrid views of idiom processing, the involvement of literal processing of idioms depends on their familiarity (Cacciari & Tabossi, 1988; Titone & Connine, 1999). Familiar (or predictable) idioms are processed as a whole whereas idioms that are less familiar (or less predictable) are analyzed at a more literal level. This view thus predicts that the literality/decomposability (= a variable indexing the consistency of the mapping between the literal and figurative meanings) and frequency/predictability variables should interact. To test for such an interaction, it is first necessary to have literality and frequency norms for a set of idioms. Thus, the availability of norms makes it possible to distinguish between different views of idiom processing. Thanks to the norms on idiomatic expressions, the issue of their putative embodied nature has also been addressed (e.g., Kacinik, 2014) and it seems that, as for other types of expressions, the meaning of idiomatic expressions is linked to perceptual and motor experiences. Finally, the processing of proverbs has also been explored, although to a lesser extent than idioms. Several issues have been addressed such as the impact of context on proverb comprehension (Ferretti et al., 2007; Katz & Ferretti, 2001, 2003), how proverbs are interpreted by older adults (e.g., Uekermann, Thoma, & Daum, 2008) or by patients (e.g., Murphy et al., 2013; Rehmel, Brown, & Paul, 2016). What is more, the neural substrates of proverb processing have been investigated (e.g., medial-frontal brain regions, Murphy et al., 2013; see also Bohrn, Altmann, Lubrich, Menninghaus, & Jacobs, 2012). The views put forward on proverb processing are certainly compatible with those on idioms (e.g., Katz & Ferretti, 2001). Nevertheless, given that differences have been identified in the processing of proverbs and idioms, these two types of fixed expressions cannot simply be lumped together (Cacciari, 2014). However, exactly how the processing of proverbs differs from that of idioms is an issue that remains to be addressed thoroughly, and norms collected for proverbs should be very helpful in this regard.

This study

The aim of this study was to increase the pool of norms available for fixed expressions. In French, only two normative studies have been conducted on idiomatic expressions (Bonin et al., 2013; Caillies, 2009) and none on proverbs. The collection of norms also makes it possible to investigate their relationships. Previous studies have found certain correlations among different norms (e.g., between familiarity and knowledge/meaning; Bonin et al., 2013; Tabossi et al., 2011), and we wanted to assess the generality of the pattern of correlations found for idioms. Critically, we were also interested in whether the pattern of correlations found among certain variables for idioms would hold true for proverbs.

In sum, norms for fixed expressions are useful both methodologically and theoretically. For example, if we were to investigate the influence of familiarity of proverbs in reading, norms on this dimension have to be made available. At the same time, it is essential to have information on a number of other potential confounding factors, such as their AoA, to take them into account factorially or statistically. At a theoretical level, having norms helps distinguish between different views of the processing of figurative expression (Cacciari, 2014).

Method

Participants

In total, 220 undergraduate students (38 males) at the University of Bourgogne (mean age = 20.49 years, standard deviation [*SD*] = 3.35, range = 17-36) took part in the rating tasks and were given course credits. Each participant took part in only one of the seven rating tasks (at least 30 per group). (As explained below, one rating task—knowledge—included two consecutive types of ratings made by the same participants.) All had normal or corrected-to-normal vision.

Stimuli

French idioms ($N = 160$) were selected from a book on French idiomatic expressions (Guilleron, 2011). French proverbs ($N = 160$) were taken from a dictionary (Pierron, Montreynaud, & Suzzoni, 2015). We were careful to choose idioms different from those used in our previous French study on idiomatic expressions (Bonin et al., 2013). When selecting the proverbs and idioms, we chose only those that we thought were likely to be known by a

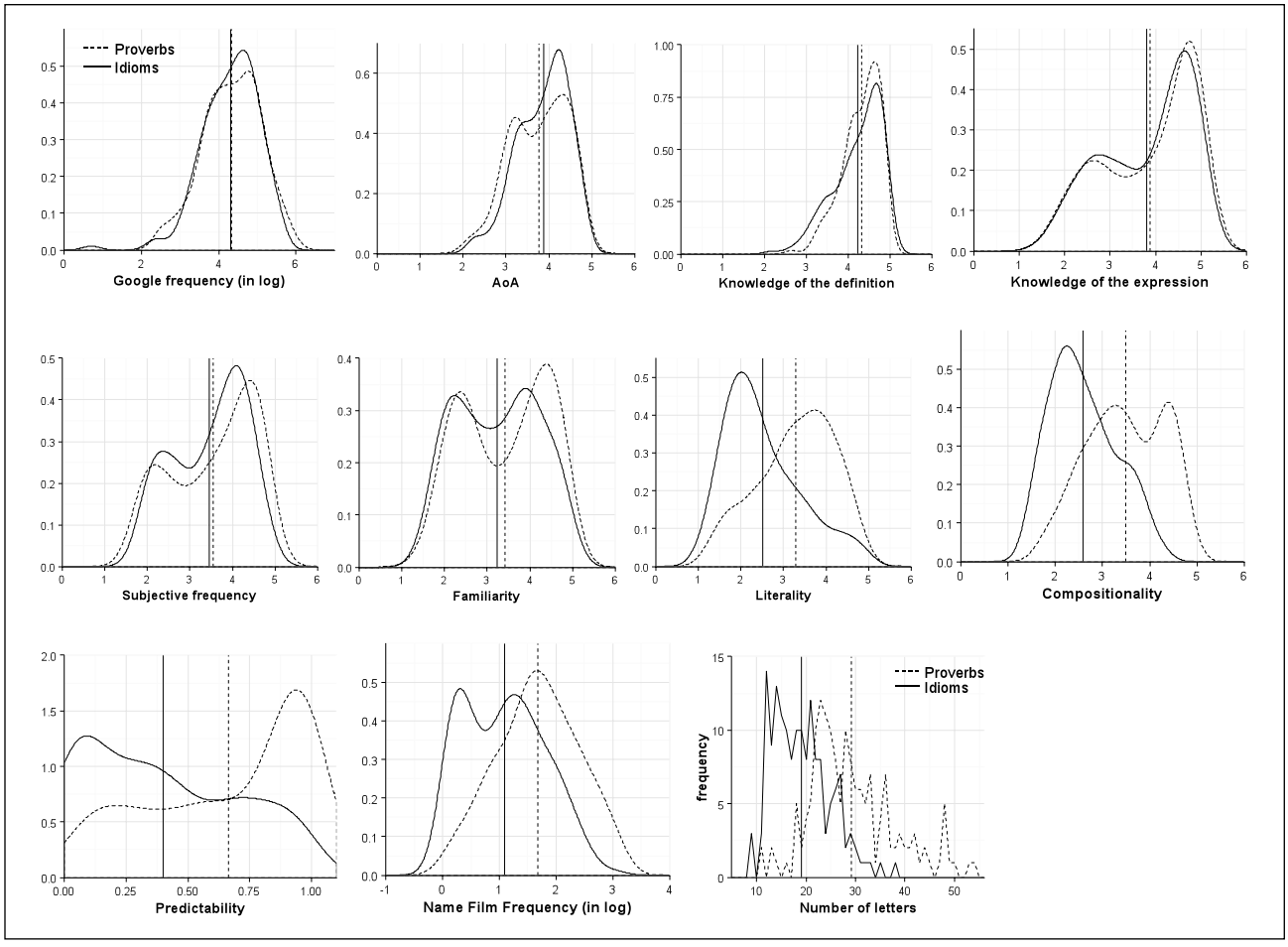


Figure 1. Density estimations of the distributions of the norms for idioms and proverbs (vertical-lines = means for proverbs and idioms) and frequency polygon for number of letters.

majority of French undergraduates. Furthermore, we selected proverbs that we thought were not at all figurative (see section "Results" and Figure 1 for the distribution of the proverbs [versus idioms] on the literality dimension as assessed by the participants in this study).

Procedure

The participants first gave their consent. Before each type of rating, full instructions with examples were given. Readers who are interested in the precise instructions given to the participants in the rating tasks are referred to the Supplemental Materials. Each participant then rated all the idioms for knowledge (of the expression, and then, of the definition), subjective frequency, familiarity, compositionality or literality on a 5-point Likert scale.

Two subscales were used to rate the "knowledge" of the fixed expressions. The participants had to first evaluate the degree to which they knew a given expression (1 = *absolutely no idea*, 5 = *absolutely certain of its meaning and able to explain it verbally*). This way of assessing knowledge of the expression is very similar to the approach used by Libben and Titone (2008) and is referred to as "meaningfulness." Immediately after providing this rating, the participants were presented with the real definition and had to evaluate using a 5-point Likert scale the degree to which they really knew the *definition* of the fixed expression that had just been presented.[2]

Two measures of "frequency of encounter" were taken into account: subjective frequency and familiarity. To assess subjective frequency, the participants had to rate the frequency with which they thought they read, heard or produced each idiom or proverb (1 = *never heard, read or produced* and 5 = *heard, read or produced very often*). Importantly, the rating had to be provided irrespective of the individuals' knowledge of the meaning of the expression. In contrast, to rate familiarity, the participants were told, as in Tabossi et al. (2011) and in Bonin et al. (2013), to rate how well they thought the expression was known by people like them, independently of whether or not they knew it themselves (1 = *unknown*, 5 = *known by everyone*). As stated earlier, this measure of familiarity makes it

possible to gauge the degree of familiarity of each idiom relative to other idioms (Tabossi et al., 2011).

In normative studies on isolated words, it is common practice to collect AoA ratings, but this is less frequent in normative studies of fixed expressions. The participants had to estimate the age at which they thought they had learned each fixed expression (in its written or oral form), with the five values of the scale corresponding to 3-year age bands with 0-3 at one extreme and 12+ at the other. The values were then converted to numerical values from 1 to 5.

Compositionality (also referred to as decomposability), literality and predictability are all scales that are specific to fixed expressions. An idiom or a proverb is decomposable if its constituent parts contribute to its meaning. For example, in the idiomatic expression *Avoir quelqu'un dans le nez* whose meaning is not to tolerate someone, the meanings of the different parts (avoir [to have], quelqu'un [someone], dans le nez [in the nose]) contribute little or nothing to the figurative meaning of the expression. On the contrary, the idiom *Etre rouge de colère* meaning to be flushed with anger is made of different parts (être [to be], rouge [red], de colère [with anger]) that contribute to its meaning. In line with the procedure used by Bonin et al. (2013) to rate the compositionality of the different fixed expressions, the participants were told that an idiom was considered decomposable if its constituent parts contribute to the meaning of the expression. A rating of 1 indicated that the idiom was not decomposable and 5 indicated that the expression was fully decomposable. Indeed, in Bonin et al.'s (2013) study, the mean rating (on a 5-point scale) for the decompositionality of *Avoir quelqu'un dans le nez* was 1.64. By contrast, the idiom *Etre rouge de colère* was rated as 4.46. The participants were given concrete examples in the compositionality rating instructions.

To evaluate the literality of a proverb or an idiom, the participants had to determine the degree to which they found that the expression had a plausible literal meaning (1 = *absolutely not plausible*, 5 = *completely plausible*). To illustrate, the English idiom *Pick one's brains* may be rated as not really plausible because it is not semantically plausible to Pick one's brains, first because the action is not easily performed, and second, because individuals have only one brain not many. Also, the French idiom *Chercher midi à quatorze heures* (literally translated: To look for noon at 2 p.m.) meaning to complicate things/look for a problem where there is none is semantically implausible because it is impossible for two different points in time to occur simultaneously! In these cases, the idioms have no literal sense.

To assess predictability, adults had to read incomplete sentences and to provide the last word in each case. The fixed expressions were presented in exactly the same way as for the other ratings, i.e., in their canonical forms which, in the case of idioms, is most often an infinitive form. For example, we presented the idiomatic expression *Chercher midi à quatorze* _____ and the participants had to fill in the blank with a word that made sense to complete the expression. The predictability score for each fixed expression corresponded to the percentage of participants who accurately identified the missing word. (We did not transform the percentages into a Likert scale.)

The length of the fixed expressions was expressed in terms of the number of letters (calculated with Excel). In Bonin et al.'s (2013) study, objective noun frequency was, among other objective frequency measures, the variable that was the most highly correlated with the other psycholinguistic variables. We therefore took objective noun frequency into account. The frequency values (subtitle frequency) were taken from the Lexique database (New, Brysbaert, Véronis, & Pallier, 2007). Finally, we entered each expression in the Google search engine to estimate its frequency (Google frequency).

Results

The norms corresponding to each idiom or proverb are available in the Supplemental Material as an Excel file. Also the SPSS syntax and *R* scripts that were used to perform certain analyses are provided as Supplementary Material.

Data analyses

Several analyses were performed on the data and are reported below. First, we computed reliabilities for different collected norms. Second, descriptive statistics are reported for both idioms and proverbs and the distributions of different norms for both types of expressions are compared. Third, the bivariate correlations are reported, and to analyze and summarize the correlational structure of both idioms and proverbs, we also report the results from a hierarchical clustering and a principal component analysis (PCA) performed separately for the two types of expressions. Finally, partial correlations are reported and described. These correlations were computed to evaluate whether the bivariate correlations still held when the effects of the other variables were controlled for.

Reliability of collected norms

For each norm and for both idioms and proverbs, Table 1 reports Cronbach's alpha. With the exception of the ratings of knowledge of the definition, for which reliability scores were a little lower, all of the scores were above 0.85, indicating that the reliability of the different norms was generally high. Unlike Tabossi et al. (2011), who found that AoA ratings were less reliable than the other norms, we did not observe lower AoA reliability compared to the other collected norms.

Table 1. Cronbach's alpha for the different norms.

	Familiarity	Subjective frequency	Knowledge of expression	Knowledge of definition	Predictability	Compositionality	Literality	AoA
Idioms	0.97	0.96	0.95	0.67	0.94	0.92	0.94	0.93
Proverbs	0.97	0.97	0.96	0.63	0.87	0.95	0.94	0.93

AoA: age of acquisition.

Descriptive statistics. Table 2 reports descriptive statistics for the different psycholinguistic variables for idioms and proverbs separately, and Figure 1 shows the distributions of the different norms.

Kolmogorov–Smirnov and mean difference tests revealed no reliable differences between the distributions or between the means for idioms and proverbs on Google frequency (in log), AoA and knowledge of the definition. For both idioms and proverbs, the distributions of these variables were slightly negatively skewed, with means and medians located at the right of the scales (see Figure 1). As mentioned earlier, AoA is a variable that has rarely been collected in studies on fixed expressions. It is interesting to note that the minimum values were 2.23 and 2.10 for idioms and proverbs, respectively, meaning that the corresponding expressions were estimated to be acquired as early as 4 years 8 months and 4 years 4 months! (the idiom *Compter pour du beurre* [count for nothing], the proverb *Qui va à la chasse perd sa place* [move your feet, lose your seat]). More precisely, we found that 11 of the idioms and 19 of the proverbs were estimated to be acquired as early as 7 years of age.

The same properties were found for the "knowledge of the expression" variable, but with a less marked unimodal distribution (a slight second mode was observed). This non-unimodal property was also observed for the distribution of subjective frequency scores. The distributions of the scores for this variable were, moreover, significantly different between idioms and proverbs ($p < 0.05$ in the Kolmogorov–Smirnov test), with a weak right shift for the distribution of subjective frequency scores for proverbs. The subjective frequency means were, however, not significantly different (given the distributions of this variable, the tests were done both parametrically and using bootstrap). The means and the distributions of familiarity ratings were not significantly different (but $p = 0.055$ in the Kolmogorov–Smirnov test). At the level of familiarity, there was a trend toward bimodal distributions for both types of expression. Furthermore, unimodality was excluded at a significant level for proverbs (dip test = 0.055, $p < 0.001$; bimodality coefficient = 0.627 > 0.555).

For proverbs, a slight negative skew combined with a relatively flat-topped curve was observed for compositionality and literality. In contrast, for idioms, a positive skew was found for these two variables, thus, resulting in distributions and means that reliably differed. This pattern of results is not surprising because, compared to idioms, proverbs are generally literally and figuratively true statements (Ferretti et al., 2007). The same properties held true for predictability even though the scores were more uniformly distributed across the entire scale. Finally, the means of the length and noun frequency variables were also higher for proverbs than for idioms, with a gap toward the right of the distribution being observed in the case of proverbs.

Bivariate correlations, hierarchical clustering and PCA

Bravais–Pearson correlations[3] (Table 3) were computed between the mean ratings for each item on all of the rating measures as well as with objective measures.

A summary of these correlations can be seen in Figure 2, which shows for each category of fixed expressions the dendrogram resulting from a hierarchical clustering algorithm using the complete linkage agglomerative rule (the default in the *hclust* function of *R*) applied to a "distance" between two variables defined as one *minus* the absolute value of their correlation. To provide a more in-depth exploration of the potential underlying factors suggested by this representation, each dendrogram is accompanied by a table indicating the loadings obtained from a varimax rotation computed on the first two components of a PCA performed for the type of expression considered (with pairwise exclusions for the correlation computations).

For both idioms and proverbs, subjective frequency, familiarity and knowledge of the expression were very highly correlated ($r > 0.9$). Strong relationships ($|r| > 0.65$) were also found between these variables and knowledge of the definition and AoA (with early acquired expressions judged as more familiar, frequent and known; this type of pattern was also found in Chinese idioms, Li et al., 2016). These variables contributed the most to the first rotated component. In addition, but for proverbs only, predictability contributed at nearly the same level to this component; the correlations between subjective frequency, familiarity and knowledge of the expression, and predictability were indeed very high ($r \approx 0.9$) for proverbs, whereas for idioms, they were clearly lower ($r \approx 0.5$). It is worth noting that the positive correlation between familiarity and predictability, i.e., the more familiar participants were with an idiom or a proverb, the more likely they were able to complete it

Table 2. Descriptive statistics for the subjective norms and other objective variables for idioms and proverbs.

	Familiarity	Subjective frequency	Knowledge of expression	Knowledge of definition	Predictability	Compositionality	Literality	AoA	Google frequency (log)	Subtitle frequency of the noun	Length
Idioms											
Mean	3.24	3.46	3.81	4.23	0.40	2.59	2.51	3.87	4.31	1.08	19.03
SD	0.96	0.86	0.99	0.58	0.31	0.69	0.90	0.59	0.73	0.71	5.73
Q1	2.30	2.65	2.87	3.86	0.11	2.08	1.83	3.43	3.84	0.40	14
Median	3.28	3.67	4.15	4.35	0.36	2.49	2.30	3.96	4.38	1.08	18
Q2	4.03	4.14	4.67	4.70	0.67	3.07	3.08	4.30	4.82	1.62	23
Skew	0.01	−0.35	−0.54	−0.94	0.39	0.43	0.85	−0.57	−0.98	0.28	0.62
Min	1.50	1.78	1.47	2.17	0.00	1.40	1.07	2.23	0.78	0.00	9
Max	4.93	4.92	5.00	5.00	1.00	4.27	4.90	4.83	5.59	2.99	38
Proverbs											
Mean	3.42	3.55	3.87	4.32	0.66	3.48	3.29	3.77	4.34	1.67	29.14
SD	1.01	0.99	1.02	0.46	0.32	0.81	0.90	0.67	0.75	0.72	8.64
Q1	2.43	2.58	2.93	4.05	0.37	2.87	2.62	3.24	3.80	1.16	23
Median	3.58	3.75	4.22	4.44	0.80	3.47	3.42	3.85	4.37	1.70	28
Q2	4.39	4.47	4.80	4.69	0.96	4.26	3.97	4.33	4.90	2.20	33
Skew	−0.15	−0.43	−0.59	−0.88	−0.59	−0.19	−0.41	−0.34	−0.31	−0.09	0.69
Min	1.37	1.61	1.59	2.64	0.00	1.77	1.30	2.10	2.47	0.06	11
Max	4.90	4.97	5.00	5.00	1.00	4.73	4.93	4.89	5.94	3.12	54

AoA: age of acquisition; *SD*: standard deviation.
Q1 = 25th percentile; Q3 = 75th percentile.

Table 3. Bivariate correlations between the measured variables for idioms and proverbs.

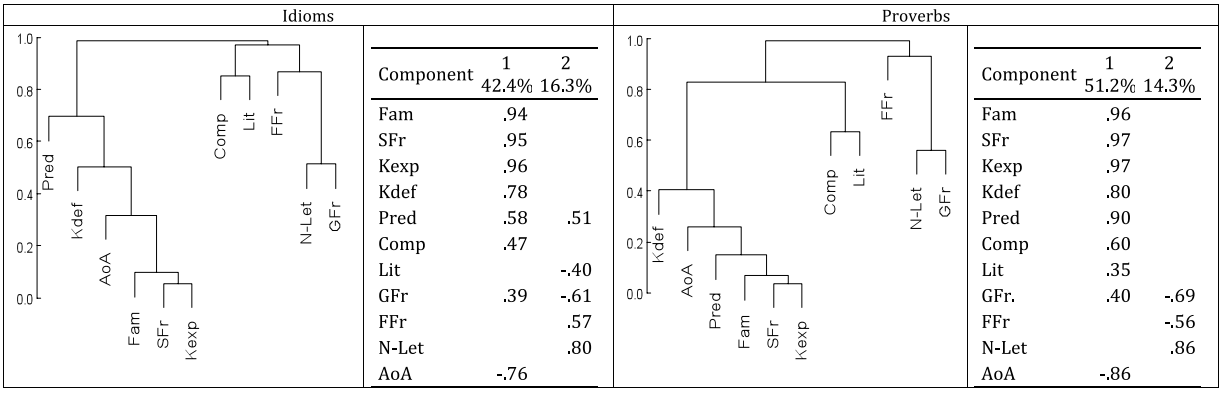
	Subjective frequency	Knowledge expression	GFI	Knowledge definition	Predictability	Compositionality	Literality	Google frequency	Noun frequency	Length	AoA
Idioms											
Familiarity	**0.92*****	0.90***	.97	0.66***	**0.45*****	0.41***	0.11	0.38***	0.15	**−0.21****	**−0.74*****
Subjective frequency		0.94***	**0.98**	0.66***	**0.52*****	0.39***	0.04	0.41***	0.10	**−0.23****	**−0.69*****
Knowledge expression			0.97	0.74***	**0.50*****	0.42***	0.03	0.35***	0.09	**−0.20***	**−0.68*****
GFI				0.71***	**0.50*****	0.42***	0.06	0.39***	0.12	**−0.22****	**−0.72*****
Knowledge definition					**0.37*****	0.48***	0.09	0.20**	−0.02	−0.03	−0.50***
Predictability						**0.08**	**−0.08**	**0.11**	**0.29*****	0.29***	**−0.30*****
Compositionality							**0.15**	0.12	−0.09	−0.03	−0.19*
Literality								**0.21****	−0.04	−0.13	**−0.01**
Google frequency									−0.13	−0.49***	−0.23**
Noun frequency										**0.22****	**−0.13**
Length											**0.18***
Proverbs											
Familiarity	**0.95*****	0.93***	0.98	0.70***	**0.85*****	0.50***	0.31***	0.39***	−0.04	**0.05**	**−0.85*****
Subjective frequency		0.96***	**0.99*****	0.72***	**0.89*****	0.50***	0.25**	0.43***	−0.05	**0.03**	**−0.83*****
Knowledge expression			0.98***	0.76***	**0.89*****	0.52***	0.24**	0.36***	−0.04	**0.08**	**−0.81*****
GFI				0.74***	**0.89*****	0.52***	0.27***	0.40***	−0.05	**0.05**	**−0.85*****
Knowledge definition					**0.64*****	0.56***	0.17*	0.24**	−0.10	0.12	−0.60***
Predictability						**0.39*****	**0.28*****	**0.33*****	**−0.02**	0.13	**−0.74*****
Compositionality							**0.36*****	0.24**	0.13	0.02	−0.35***
Literality								**−0.01**	−0.02	0.07	**−0.25****
Google frequency									0.07	−0.44***	−0.36***
Noun frequency										**−0.28****	0.03
Length											**−0.06**

GFI: general frequency index; AoA: age of acquisition.

GFI is a variable used for the partial correlation analysis which is equal to the first factor of a principal component analysis including subjective frequency, familiarity and knowledge of the expression.

$N = 160$ except for noun frequency (idioms: $N = 156$, proverbs: $N = 129$).

***$p < 0.001$; **$p < 0.01$; and *$p < 0.1$; significant differences between the correlations obtained for idioms and proverbs ($p < 0.05$) are in bold. The tests were performed using Fisher's z transformation (e.g., Howell, 2012).



Component	1 42.4%	2 16.3%
Fam	.94	
SFr	.95	
Kexp	.96	
Kdef	.78	
Pred	.58	.51
Comp	.47	
Lit		-.40
GFr	.39	-.61
FFr		.57
N-Let		.80
AoA	-.76	

Component	1 51.2%	2 14.3%
Fam	.96	
SFr	.97	
Kexp	.97	
Kdef	.80	
Pred	.90	
Comp	.60	
Lit	.35	
GFr.	.40	-.69
FFr		-.56
N-Let		.86
AoA	-.86	

Figure 2. Dendrogram and varimax rotation.
Fam: familiarity; SFr: subjective frequency; Kexp: knowledge of the expression; Kdef: knowledge of the definition; Pred: predictability; Comp: compositionality; Lit: literality; GFr: Google frequency (in log); FFr: film frequency of the noun (in log); N-Let: number of letters; AoA: age of acquisition. Explained variance is given under each component number.

correctly, has previously been found in other studies on idioms (e.g., Li et al., 2016; Tabossi et al., 2011; Titone & Connine, 1994).

Finally, as far as this component is concerned, compositionality and Google frequency (with lower correlations) complete this first group of variables, for which it was found that a higher value on one variable was associated with higher values on the others, except in the case of AoA which was negatively correlated with all the other variables. The moderate positive correlations between compositionality and knowledge of the expression (and of the definition), subjective frequency and familiarity variables suggest that, when individuals know the meaning of an idiom, their ability to gauge whether its figurative meaning is compositional is slightly enhanced. The strong correlation between familiarity and knowledge of the expression (and, to a lesser extent, knowledge of the definition) suggests that the better a participant knows a proverb or an idiom is, the more she or he rates it as familiar to others.

A far less explanatory second dimension resulted primarily from the length variable. Since the correlation between Google frequency and length was relatively large (both for idioms and proverbs, it was the largest correlations including GFr), Google frequency was also expressed on this component. Given that, with the exception of predictability for idioms, significant correlations with noun frequency were observed only for length, this pattern was also mainly expressed on this second component. However, it must be stressed that for this variable, the loading signs were reversed, meaning that the more frequent nouns were associated with longer words for idioms whereas the reverse was true for proverbs. A last noteworthy aspect of the second component was that, for idioms only, predictability was also expressed on this second factor, with a loading approximately the same as that on the first component: In effect, the predictability variable was positively correlated with the number of letters (and to a lesser extent with noun frequency). This was not the case for proverbs.

Finally, in the case of idioms, literality was (roughly) uncorrelated with the other variables, whereas for proverbs, it exhibited correlations of around 0.25 with most of the variables expressed on the first rotated component. More generally, it must be stressed that the correlations between the different norms were generally higher and more contrasted for proverbs than for idioms. As a result, more variance was explained by the first factor of the component analysis for proverbs. The finding of higher correlations for proverbs was particularly noticeable for predictability and, to a lesser extent, for literality. This pattern of correlations is not surprising because the mappings between literal and figurative meanings are more stable for proverbs than for idioms.

Partial correlations

As mentioned above, to assess whether the bivariate correlations described above were still observed when the effects of the other variables were controlled for, we computed partial correlations. Table 4 (starting from the fourth column) provides the correlations between pairs of norms for which the absolute difference between the bivariate and the partial values was above 0.20. It is important to note that, given the very high correlations between subjective frequency, familiarity and knowledge of the expression, we decided to replace them by the by-items scores obtained from the first component of a PCA performed on these variables. (These components represented 94.9% and 96.6% of the variance for idioms and proverbs, with all correlations between variables and factorial scores being higher than 0.96; see Table 3.) For the sake of clarity, the by-items scores are referred as "general frequency index" (GFI). It should also be noted that since values for noun frequency were not available for 4 idioms and 21 proverbs, and given that pairwise correlations of this variable with the other variables were generally low, we took the decision to exclude noun frequency from the analyses.

Table 4. Partial correlations differing more than 0.2 from bivariate correlations.

R between		Bivariate *r*	Partial *r*	Partial − 1	Partial − 2	Partial − 3	Partial − 4
GFI, Kdef	Idioms	0.71***	0.43***	0.55 (AoA)	0.65 (Comp)		
	Proverbs	0.74***	0.30***	0.44 (Comp)	0.54 (Pred)	0.69 (AoA)	
GFI, Comp	Idioms	0.42***	0.30***				
	Proverbs	0.52***	0.29***	0.44 (Kdef)			
GFI, GFr	Idioms	0.39***	0.19*	0.28 (Pred)	0.34 (Let)		
	Proverbs	0.40***	0.09	0.19 (Pred)	0.37 (AoA)		
GFI, Lit	Idioms	0.06	−0.03				
	Proverbs	0.27***	−0.06	0.07 (Pred)	0.21 (AoA)		
GFI, AoA	Idioms	**−0.72****	−0.59***				
	Proverbs	**−0.85****	−0.59***	−0.72 (Pred)	−0.79 (Kdef)		
Kdef, Pred	Idioms	**0.37****	0.00	0.26 (GFI)	0.37 (AoA)		
	Proverbs	**0.64****	0.01	0.33 (GFI)	0.54 (AoA)	0.57 (Comp)	
Kdef, Comp	Idioms	0.48***	0.26**	0.45 (GFI)			
	Proverbs	0.56***	0.33***	0.46 (GFI)			
Kdef, GFr	Idioms	0.20**	−0.03	0.06 (GFI)	0.13 (Pred)		
	Proverbs	0.24**	−0.07	−0.04 (Comp)	0.03 (GFI)	0.1 (Pred)	0.33 (AoA)
Kdef, Lit	Idioms	0.09	0.06				
	Proverbs	0.17*	−0.16	−0.05 (Comp)	−0.03 (GFI)	0.03 (Pred)	0.16 (AoA)
Kdef, AoA	Idioms	−0.50***	−0.03	−0.38 (GFI)	−0.46 (Pred)		
	Proverbs	−0.60***	−0.00	−0.23 (GFI)	−0.49 (Pred)	−0.52 (GFr)	
Pred, Comp	Idioms	**0.08**	−0.23**	−0.11 (GFI)	0.01 (Kdef)		
	Proverbs	**0.39****	−0.23**	−0.033 (GFI)	0.14 (Kdef)	0.23 (AoA)	0.33 (GFr)
Pred, GFr	Idioms	**0.11**	0.12				
	Proverbs	**0.33****	0.06	0.18 (GFI)	0.33 (AoA)		
Pred, AoA	Idioms	**−0.30****	0.13	−0.21 (GFI)	−0.34 (Kdef)		
	Proverbs	**−0.74****	0.13	−0.51 (GFI)	−0.64 (Kdef)		
Pred, N-Let	Idioms	0.29***	0.49***	0.42 (GFI)	0.36 (GFr)		
	Proverbs	0.13	0.18*				
Comp, AoA	Idioms	−0.19*	0.20*	0.04 (GFI)	−0.16 (Kdef)		
	Proverbs	−0.35***	0.22*	0.06 (GFI)	−0.06 (Kdef)	−0.2 (Pred)	−0.29 (GFr)
GFr, AoA	Idioms	−0.23**	0.10	−0.02 (GFI)	−0.15 (Let)		
	Proverbs	−0.36***	−0.09	−0.19 (GFI)	−0.33 (Pred)		

GFI: general frequency index; Kdef: knowledge of the definitions; Comp: compositionality; GFr: Google frequency; Lit: literality; AoA: age of acquisition; Pred: predictability; N-Let: number of letters.

Pairs of variables for which the absolute difference between bivariate and partial correlations was below 0.2 are not shown (except for those for which this was the case for only one of two types of expressions). Partial − *n* = partial *r* when the *n* variables figuring in brackets in the column and in the preceding columns named "Partial − *n*" are excluded.

***$p<0.001$; **$p<0.01$; and *$p<0.1$; significant differences between the correlations obtained for idioms, proverbs ($p<0.05$) are in bold.

At first glance, the differences that were found between bivariate and partial correlations were more salient for proverbs than for idioms. This observation is not really surprising because of the higher bivariate correlations that were found for proverbs. The direction of the differences was, however, generally the same for both types of expressions. To study which control variables were mainly responsible for the differences, we began by taking into account the variable that, when removed, caused the two correlations to become closer. Each time the absolute difference between the partial and the bivariate correlations was above 0.10, a second control variable was excluded following the same logic. This procedure was repeated until the 0.10 criterion was satisfied. Three aspects are worthy of note. First of all, GFI turned out to be the control variable that gave rise to the largest differences between simple and partial correlations. Except for literality and length, the correlations between nearly all pairs of variables were greatly reduced when GFI was controlled for. This was particularly noticeable for the following pairs: Predictability and AoA, knowledge of the definition and AoA, knowledge of definition and predictability. For these pairs of variables, the high (bivariate) correlations completely vanished when GFI was controlled for. To a lesser extent, this was also the case for the correlation of Google Frequency and AoA. It is worth noting, however, that even though the correlations between GFI and predictability, AoA, knowledge of the definition and Google frequency were reduced when the other variables were controlled for, they were still significant and kept the signs of the bivariate

correlations. Second, we found that the signs were reversed for the correlations between compositionality (vs AoA) and predictability. If excluding GFI from the control variables caused the partial correlations to become unreliable, it is also necessary to exclude knowledge of the definition and, in the case of proverbs, two other variables, to obtain comparable bivariate and partial correlations. Finally, for idioms only, the correlation between predictability and length was greater when the other variables were controlled for and both GFI and Google frequency were excluded, thus making it possible to use comparable values for both correlations.

General discussion

Comparisons with other studies

For idioms, the pattern of bivariate correlations found here was very similar to that obtained by Bonin et al. (2013) and the values were larger than those obtained by Caillies (2009). One noticeable difference is that Bonin et al. (2013) obtained larger correlations between compositionality and the other variables expressed on the first rotated component.

The correlations obtained for the idioms were mostly situated inside the confidence intervals computed by Nordmann and Jambazova's (2017) meta-analysis of normative studies of idiomatic expressions. There were two noticeable exceptions: (1) The correlation between familiarity and knowledge of the expression was a little lower in this study, and (2) The sign of the correlation between predictability and AoA was reversed. The comparison of this meta-analysis with the correlations obtained for proverbs revealed that they were generally more pronounced, in particular for predictability. Finally, and again in line with Nordmann and Jambazova's meta-analysis, noun frequency and length were poorly correlated with the other variables. The only exception was the moderate negative correlation between length and Google frequency, which is consistent with Citron et al. (2016) who found, using rated familiarity, that short idioms are encountered or produced more frequently.

Utility of the database

Thank to this new set of norms, it will be possible to design studies aimed at investigating the determinants of reading-comprehension times and accuracy of idioms and proverbs. One approach to achieve this aim consists in using long lists of items and multiple regression analyses, i.e., so-called megastudies (e.g., Balota, Yap, Hutchison, & Cortese, 2012). This approach has rarely been used in the literature on fixed expressions (e.g., Bonin et al., 2013), in contrast to the large number of megastudies conducted in the field of visual word recognition (e.g., Ferrand et al., 2010; see Keuleers & Balota, 2015, for a review) where it has been proven to be very successful since it has greatly helped constrain views of word recognition (see Balota et al., 2012). This study has revealed that idioms and proverbs are very closely related and we therefore anticipate that most of the determinants of idiom processing in comprehension should be the same as in proverb processing. However, given the finding that proverbs are estimated to have more literal meanings than idioms, it is possible to anticipate that literality might play a stronger role in the comprehension of proverbs than in that of idioms. In sum, the current norms should help us achieve a better understanding of the processes that are shared by, and those that are specific to, the processing of idioms and proverbs, respectively. Also, and importantly, the megastudy approach has also made it possible to discover new and important variables, e.g., the word prevalence variable in the field of visual word recognition (Brysbaert, Stevens, Mandera, & Keuleers, 2016; Keuleers, Stevens, Mandera, & Brysbaert, 2015). The norms will also be useful to design studies that are aimed at investigating the processing of figurative expressions embedded in different linguistic contexts such as texts and that use different types of measures to assess comprehension such as self-paced word-by-word reading, or eye movements during reading. Finally, even though AoA norms have not been frequently collected for fixed expressions, this study has shown that it is important to collect them for idioms and proverbs because they may provide interesting and useful information. As claimed in the introduction, idioms are generally thought to be acquired rather late in life. However, we found that some idioms, and also proverbs, are learned as early as 5 years of age (and indeed a close examination of the 10 idioms and proverbs that had the lowest AoA scores showed that these are the ones that are generally addressed to children). AoA norms for fixed expressions would be very useful, especially for researchers who want to study the understanding and the production of these expressions in children (e.g., Caillies & Le Sourn-Bissaoui, 2008).

In conclusion, we have provided psycholinguistic norms in French for a new set of 160 idiomatic expressions and also for 160 proverbs. The norms will be helpful when designing factorial or multiple regression studies aimed at investigating the processes involved in the comprehension or production of fixed expressions.

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Supplementary Material

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Notes

1. In the field of word recognition, a new variable—word prevalence—has been discovered that corresponds to word knowledge in the population, i.e., the proportion of a population knowing a particular word (Keuleers et al., 2015). This measure (that was not collected in our study), although not equivalent to our measure of familiarity of idioms, can be conceived as a measure of the "popularity" of a linguistic item. Prevalence has been found to be a strong determinant of word recognition times. In effect, this variable has the second highest correlation with lexical decision times after word frequency (Brysbaert et al., 2016).
2. As pointed out by a reviewer (Francesca Citron), the measure we chose to evaluate the knowledge of the idioms may be criticized on the grounds that certain participants may express some confidence that they know the meaning of some idioms, while still defining them erroneously (e.g., Citron et al., 2016). Another way to assess knowledge of idioms would therefore have been to ask the participants to provide a definition (e.g., Citron et al., 2016; Tabossi et al., 2011). We acknowledge that this procedure is an interesting alternative, even though it is a somewhat difficult and time-consuming task. Also, as pointed out by Bonin, Méot, and Bugaiska (2013), one potential weakness of relying on definitions to assess knowledge of idioms and proverbs is that it cannot be excluded that certain participants may strategically answer that they do not know the definition of an expression to avoid having to produce it.
3. It is worth noting that the use of Bravais-Pearson correlations could be questioned because of the lack of normality of certain variables (as suggested by Figure 1). However, given that Spearman correlations provided roughly the same patterns of correlations, we did not think it necessary to transform them to ensure the normality of all the distributions.

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