The British Sign Language (BSL) norms for age of acquisition, familiarity, and iconicity. Behavioral Research Methods, 40, 1079–1087

5 AUTHORS, INCLUDING:

David Vinson
University College London
62 PUBLICATIONS   1,602 CITATIONS

SEE PROFILE

Tanya Denmark
King's College London
11 PUBLICATIONS   71 CITATIONS

SEE PROFILE

Adam Schembri
La Trobe University
51 PUBLICATIONS   405 CITATIONS

SEE PROFILE

Gabriella Vigliocco
University College London
120 PUBLICATIONS   3,790 CITATIONS

SEE PROFILE

Running head: BSL norms

The British Sign Language (BSL) Norms for Age of Acquisition, Familiarity and Iconicity

David P. Vinson, Kearsy Cormier, Tanya Denmark, Adam Schembri and Gabriella Vigliocco

Deafness, Cognition and Language Research Centre

University College London

Corresponding author:
David P. Vinson
Deafness, Cognition and Language Research Centre
University College London
49 Gordon Square, London, WC1H 0PD
United Kingdom
Tel: +44 (0)20 7679 8688
Email: d.vinson@ucl.ac.uk

Abstract

Research on signed languages offers the opportunity to address many important questions about language which may not be possible to address via studies of spoken languages alone. Many such studies, however, are inherently limited because there exist hardly any norms for lexical variables that have appear to play important roles in spoken language processing. Here we present a set of norms for age of acquisition, familiarity and iconicity for 300 British Sign Language (BSL) signs, as rated by deaf signers, in the hope that they can prove useful to other researchers of British Sign Language and other signed languages. These norms may be downloaded from www.psychonomic.org/archive.

Keywords: Signed languages, age of acquisition, familiarity, iconicity

The British Sign Language (BSL) Norms for Age of Acquisition, Familiarity and Iconicity

For many years psycholinguistic research has been dominated by studies of spoken languages[1], leading to a current situation in which evidence from these languages is generally taken to represent language as a whole. Within this kind of framework, important advancements have been made by contrasting different languages with different properties, leading to theoretical refinements at various levels of detail (e.g. Slobin, 1996). But in many cases, these kinds of contrasts are limited to comparisons between spoken languages, neglecting signed languages which can provide important evidence about language in general. For example, spoken languages rely primarily upon a single articulator, while signed languages involve multiple articulators (both hands, mouth, face, body, etc.) operating in tandem, a difference that has numerous implications for models of comprehension and production (Emmorey, 2002). Of course, such differences do not rule out the possibility that processing of spoken and signed languages are very similar in nature, but research on signed languages is crucial to identify convergence and divergence between the two (e.g., Thompson, Emmorey & Gollan, 2005, revealed both important similarities and differences in tip-of-the-tongue states in spoken languages and tip-of-the-finger states in signed languages).

One important factor limiting the extent of signed language research is the absence of normative information for lexical signs. In spoken language research there are hundreds of studies highlighting the importance of various lexical properties, especially cases in which – previous theoretical conclusions are called into doubt due to experimental confounds with one or another uncontrolled lexical variable (e.g. Chiarello, Liu, Shears, & Kacinik, 2002). In turn this has led to more and more sophisticated studies designed at unravelling the contributions of various lexical variables, using normative samples of thousands of words

---

[1] We use the term "spoken languages" to refer to auditory/oral languages whether in spoken or written form, in contrast to signed languages which are visual/corporal and without writing systems.

(e.g. subjective ratings of age of acquisition, imageability and familiarity for 3394 English words from both Stadthagen-Gonzalez & Davis, 2006, and Gilhooly & Logie, 1980), in addition to massive amounts of information derived from text corpora (e.g. frequency of occurrence in the British National Corpus sample of 100 million words, www.natcorp.ox.ac.uk), and extremely large datasets (such as the English Lexicon Project (Balota, et al., 2007), containing word naming and lexical decision latencies for more than 40,000 English words, see Baayen, 2005 for further discussion). Such studies provide crucial information about the role of such variables, and highlight the importance of controlling them in various kinds of experimental studies not specifically related to them. To date, however, there has been no known large-scale study to collect such normative data on a signed language[2].

The current study is the first step in this direction, reporting deaf participants' subjective ratings of their familiarity, age of acquisition (AoA), and iconicity for a set of lexical signs from British Sign Language (BSL). We included familiarity and age of acquisition based on spoken language research indicating the important effects of these variables on various kinds of language tasks, and iconicity due to its potential role in signed languages (e.g., Vigliocco, Vinson, Woolfe, Dye & Woll, 2005).

Ratings of familiarity fulfill two roles at present. First, it has been claimed that familiarity per se plays an important role in lexical processing, thus highlighting the need to control this variable in various kinds of studies (see Balota, Cortese, Sergent-Marshall, Spieler & Yap, 2004). Second, although familiarity appears to be dissociable from objective counts of lexical frequency (Colombo, Pasini & Balota, 2006), the strong correlation between

---

[2] Only one major study of lexical frequency has been undertaken, based on a corpus of 100,000 lexical items collected from 50 hours of videotaped conversation and other text types in New Zealand Sign Language (McKee & Kennedy, 2006; see also Morford & MacFarlane, 2003 for a smaller-scale study of frequency in American Sign Language). Familiarity norms have also recently been collected for a set of signs in Spanish Sign Language (LSE, Carreiras, Gutiérrez-Sigut, Baquero & Corina, 2008).

the two allows familiarity to be used as a proxy for frequency until such time as objective measures of BSL frequency become available (at which time the dissociation between them can be investigated).

Age of acquisition, the reported age at which a speaker/signer first learned a word/sign, has also been claimed to have important effects on word recognition separable from effects of familiarity and frequency (Brysbaert & Ghyselinck, 2006; Ghyselinck, Custers, & Brysbaert, 2004). For signed language research, such measures are especially important as most learners of signed languages do not acquire a signed language from infancy, instead exhibiting a variety of acquisition profiles (e.g., Emmorey, 2002). As a result this variable may play a very different role in signed and spoken languages.

Finally, ratings of iconicity are especially important when it comes to research involving signed languages. Iconicity, the presence of a relationship between a lexical item's meaning and its phonological form, is extremely limited in most spoken languages, being mostly restricted to onomatopoeia (e.g. in English, words such as *crash*, *pow*, *buzz*, etc.). In signed languages, however, iconicity based on visual links between form and meaning is pervasive as illustrated in Figure 1. For example, the BSL lexical signs CAMERA and EAT (upper panel of Figure 1) use the hands to imitate the way humans hold objects or perform actions. Not all signs are iconic, however; some signs' phonological forms do not resemble their referents or refer to abstract concepts, such as the BSL signs BOY, EASY, IMPORTANT and RIGHT ("correct"), as illustrated in the middle panels of Figure 1). However, iconicity is not restricted to concrete objects, but can also be used metaphorically as in BSL signs like TIME and THINK (lower panel of Figure 1) Ratings of this variable can provide crucial information for experimental studies of various kinds. Beyond the obvious example of selecting items for studies investigating the role of iconicity itself, such ratings can also allow the selection of items that are well controlled to contrast spoken and signed

languages with iconicity held constant between the two, useful for example in studies aimed to investigate effects of language modality without this factor being confounded with iconicity.

FIGURE 1 ABOUT HERE

Method

Participants. Ratings were obtained from a set of 20 deaf participants for each of the three variables (AoA, familiarity and iconicity). Ratings for each variable were obtained separately, although many participants completed more than one of them. In all, 33 deaf BSL signers (18 women, 15 men) participated in the study. Because of the duration of the task, only eleven completed all three rating tasks; six completed two of the three, and the remaining 16 each completed only one.

Participants were selected based on their responses to a thorough online questionnaire which all potential participants filled in before taking part in any of the tasks. Eligible participants were those who identified themselves as deaf users of BSL who were British-born and between ages 18-62 . Participants were recruited at various events held by deafness-related organisations around the United Kingdom and through the authors' personal contacts. Most of the participants (n=29) reported that they were born deaf, with the remainder becoming deaf before the age of five.

Concerning language, all participants were BSL signers, and the vast majority considered their preferred language to be BSL[3]. Participants self-rated their BSL skills on average as 6.2 on a seven-point scale (range 5-7, s.d. 0.8). Most began to sign from early in life (14 participants started signing from birth, seven from age 3-5, while six participants began to sign at age 15 or later. They learned to sign from a variety of sources (16 from

---

[3] Two participants listed SSE (Sign Supported English: the use of BSL lexical signs but produced following English word order rather than BSL syntax) rather than BSL as their preferred language, but these participants did not statistically differ from the others on the rating tasks reported here.

family at home, 11 from friends, 9 from other students at school, and three from other

sources)[4]. Most of the participants (n=24) were born in the south-east of England, with a few

participants from other areas (five from south-west England, one from north-west England,

one from north-east England, and two from Scotland). Most participants (n=27) also currently

live in south-east England. Participants were between the ages of 18 and 62.

Materials. We initially selected a very large set of BSL signs from a variety of sources,

including dictionaries of BSL based on linguistic principles (e.g. Brien, 1992) and other

collections of signs specifically created as teaching materials (Microbooks, 2005). We also

selected as many signs as possible for clearly picturable objects and events, based on lists of

English words for which norms exist (e.g., Snodgrass & Vanderwart, 1980) together with

materials used in previous research in various domains (e.g. Cree & McRae, 2003; McRae,

Cree, Seidenberg, McNorgan, 2005; Vinson & Vigliocco, 2008, among many others). We

also selected a wide range of items varying in familiarity and AoA based on available English

norms, and we also selected a wide range of items varying in iconicity based on our own

judgements. Furthermore, we selected specific subsets of signs that might be less familiar to

many signers, including those identified as regionalisms (i.e., signs listed in the BSL

dictionary as used only in particular regions of the United Kingdom), colloquialisms, and

signs believed to be recent borrowings from foreign sign languages. Drawing on these

sources, the third author (herself a native signer) worked closely with a deaf native signer to

compile an initial list of 2,490 BSL signs. The list was then more closely examined by the

sign language linguists on the research team, who used two main criteria to select a smaller

subset of 309 (300 test items plus 9 practice items) signs for the norming study.

The first criterion was based on known organizational principles of sign language

lexicons (Brentari & Padden, 2001; Johnston & Schembri, 2007). Briefly, signs in BSL may

---

[4] Participants were allowed to indicate multiple sources, so the sum exceeds the number of
participants.

be analyzed as fitting into three major categories, based on differences in phonological, grammatical and semantic properties: core native signs (signs which behave similarly to words in a spoken language, known as "lexical signs"), non-native signs (signs based on the manual alphabet, known as "fingerspelled loan signs") and non-core native signs (highly iconic non-lexicalized signs known as "classifier constructions"). In particular, we wished to exclude classifier constructions which are highly iconic, productive, complex forms that appear to share some properties with gestural communication (Emmorey & Herzig, 2003; Schembri, Jones & Burnham, 2005) and have been the focus of very little psycholinguistic research. While we included a small number of fingerspelled loan signs (e.g., the fingerspelled sequence T-H meaning "Thursday"), the list was dominated by lexical signs.

The second criterion we used in the selection of the task was to select signs that exhibited as little polysemy as possible, and that did not have known examples of homonyms. This was motivated by a desire to ensure that the ratings for the signs used in the task actually reflected ratings for the target lexical item, and not some sign with a related meaning or formationally similar sign with a different meaning. Therefore, three deaf native signers who took part in our later stages of piloting were also asked to provide English translations in addition to their ratings. Any signs which were found to be polysemous in piloting were then excluded from the final list.

Although norming studies on spoken languages use a significantly greater number of lexical items than our set of 300 signs (e.g., Stadthagen-Gonzalez & Davis, 2006, normed a set of 1,526 English words which, when combined with the norms of Gilhooly & Logie (1980) yielded ratings for 3,394 words), this reflects the relatively longer time required for a lexical norming task in a signed language, as well as our expectation that deaf BSL signers would be more difficult to find in quantity than native English speakers. Tasks involving written stimuli can be completed very quickly, with Stadthagen-Gonzalez and Davis (2006)

reporting that each of their participants took no more than 30 minutes to rate 366 English words (a maximum of 12 seconds per word), typing their responses directly into a spreadsheet. For signed languages, participants must view and rate video clips of signs which themselves are not minimal in duration. With 300 signs, each task took between 60 and 90 minutes to complete. In addition, we collected ratings on iconicity, familiarity and AoA separately, as the duration of the combined task would have been unmanageable. By separating the three tasks, participants could choose whether to do one, two or all three tasks, at different times, and on different days if they preferred.

The final set of 309 signs was filmed by a professional film production company. Four deaf BSL signers presented the stimuli for filming; each of them presented approximately 75 signs. Before filming, two of the researchers went through the sign list with the presenters. The signs were then delivered to the presenters by the third author, a native BSL signer. The production of 90% of all 309 signs used in the task were spontaneously accompanied by the mouthing of the equivalent English word. As mouthing is a common feature of BSL discourse (Sutton-Spence & Day, 2001), we did not attempt to prevent the presenters from mouthing while being filmed.

Procedure. The resulting 300 video clips were inserted into an online survey tool, RiddleMeThis (http://www.riddlemethis.com) which is capable of presenting video stimuli and collating responses in text files. Three different surveys were created for each of the three variables (AoA, familiarity and iconicity), presenting each sign on a separate screen. The 300 signs were always presented in an individually randomised order. All consent information and instructions for the tasks were provided in written English and in BSL (video format). Breaks were provided after each set of 75 signs, and participants were also permitted to stop the task at any time and restart later; the system was set to resume at the stopping point as long as the participant continued within a month's time.

Raters for AoA were asked to estimate the age at which they think they learned each of the 300 signs. Each screen showed the target sign and a list of age ranges: (0-2), (3-4), (5-6), (7-8), (9-10), (11-12), (13-14). (15-16) and (17 or older), plus an additional option to select if they did not know that sign. Raters for familiarity were asked to estimate, on a scale of 1 to 7, how often they see each of the 300 signs (1 = participant had never seen the sign before, to 7 = participant sees the sign very often). Each screen showed the target sign and the 1-7 response scale. Raters for iconicity were asked to estimate, on a scale of 1 to 7 (1 = not at all iconic, to 7 = highly iconic), the extent to which they thought each of the 300 signs was iconic. The English version of the instructions used for each variable are shown in the Appendix. The instructions for AoA and familiarity were based largely on those used by Stadthagen-Gonzalez & Davis (2006).

During our piloting, some participants gave high iconicity ratings to signs based on the fingerspelling system of BSL (e.g. the BSL lexical sign FATHER which is based on the fingerspelled letter F), in addition to the meaning-form correspondences that we expected. Therefore we added to our instructions for iconicity a warning to participants that they should avoid conflating iconicity with motivation. That is, in order to be considered iconic, the sign had to visually resemble or represent the referent rather than a letter from the manual alphabet associated with the semantically equivalent English word.

<p align="center">Results and Discussion</p>

Each participant's responses were saved as a text file. We first examined their responses to the initial questions to ensure that each participant had indeed given their consent to participate. Next, we extracted the participants' ratings for each of the BSL signs. In some cases (1.3% of all signs), a sign was presented to a participant more than once in the course of the task; this usually occurred when a participant stopped the task and resumed later. In these instances, the average of the multiple responses was taken.

For the familiarity task, participants' responses were simply values on a 1-7 scale and required no further processing. The iconicity task also permitted a response of "8" ("I don't know the meaning of the sign"); we only considered values of 1-7 as iconicity ratings. Finally, we converted AoA ratings from ranges into numeric values; for all intermediate values this was done by taking the midpoint of a range (e.g. "age 5-6" was assigned a value of 5.5). The endpoints of the scale were treated differently; range "0-2" was given a value of 1.5, and range "17+" a value of 17.5. This latter conversion will necessarily result in an underestimate of the age of signs learned in adulthood, so AoA values in the high teens should not be thought of as an accurate reflection of the actual age. Average iconicity, familiarity and age of acquisition ratings for all items across participants are provided as supplementary materials (available for download, see "Archived materials").

Our next step was to remove those signs that were generally unfamiliar to a majority of our participants, as the reliability of average ratings is in doubt in such cases. We decided to exclude any signs which were given ratings of "I don't know this sign" by more than half of the participants in either the iconicity or AoA rating tasks (the familiarity rating scale did not allow "don't know" responses[5]). There were 15 such signs, of which all but one were regional signs unknown to the majority of our participants (see Brien, 1992). Familiarity ratings confirmed that these signs were highly unfamiliar overall (average familiarity rating was 1.89 on a seven-point scale). These items were removed before further analyses were conducted. Our next step was to carry out an informal assessment of the items which received ratings at the extremes of each scale, to see whether average ratings matched our intuitions.

The signs which received the highest iconicity ratings are those signs which would generally be considered transparently iconic - i.e. one would expect their meanings to be

---

[5] The familiarity rating scale did not allow "Don't Know" responses, because in that task we were specifically looking for the degree to which a sign was familiar or unfamiliar. The instructions asked participants to rate a sign as 1 if they had never seen the sign before.

easily guessed even by non-signers (Lieberth & Gamble, 1991). Signs rated as most highly iconic included examples like CAMERA (average rating 6.85) and EAT (6.80) which are highly recognizable even by non-signers (illustrated in the upper panel of Figure 1). The motivation of these signs is similar to ASL signs rated as transparently iconic by non-signers (Lieberth & Gamble, 1991). Signs with low iconicity ratings included examples like EASY (1.60), BOY (1.85), IMPORTANT (2.45) and RIGHT (2.30) which do not exhibit any apparent resemblance to referents, as illustrated in the middle panels of Figure 1. It is important to note that a few of the signs with the very lowest iconicity ratings also received very low familiarity ratings (see below). It is not surprising that less familiar signs will also receive low iconicity ratings, as participants may be unable (or somewhat unable) to visualize the referent. For this reason, iconicity ratings for items rated low in familiarity may underestimate true iconicity among individuals who are familiar with a particular sign, an important consideration for use of such items in experimentation.

The items rated as the most familiar are all concepts regularly used in everyday conversation: WORK (6.90), EAT (6.85) and WHAT (6.80), while the least-familiar signs include BASINGSTOKE[6] (1.95), ADDRESS (2.35), OF-COURSE (2.35), SHABBY (2.45), PEOPLE (2.55)[7]. For age of acquisition, signs rated as the earliest acquired are EAT (3.17 years), ICE-CREAM (3.61), CRY (3.61), DRAW (4.32), DUCK (4.50), RABBIT (4.50).[8] The latest-acquired signs, were a mix of abstract signs, specific locations, and modern technology only recently added to the BSL lexicon (e.g. METAPHOR, 17.14; BASINGSTOKE, 16.83; DVD, 16.61; WEBCAM, 16.57; EMAIL, 16.50; MALAYSIA, 16.50; MELBOURNE, 16.50). In addition to examining the ends of the scales, we also looked

---

[6] Basingstoke is a small town in south England.
[7] Many of the signs rated as less familiar were listed as regional signs (Brien, 1992).
[8] The numeric values given here do not necessarily estimate the actual age at which a child learning BSL from infancy may acquire a given sign, due to the varying linguistic profiles of our participants. Instead they should be considered relative measures only, with smaller values indicating that sign is typically acquired earlier than signs with larger values.

at the distribution of ratings across each scale by creating frequency histograms (see Figure 2)

FIGURE 2 ABOUT HERE

AoA ratings (top panel) were distributed across the scale, illustrating that participants

tended to use the entire range of possible ages (most participants learned BSL early in life so

this was possible). Ratings of iconicity, instead, were bimodally distributed, indicating

perhaps a tendency towards a distinction between those signs that are considered to be iconic

and those that are not. Finally, familiarity ratings were heavily skewed toward the higher end

of the scale[9]. One explanation for this might be that our item selection process favored signs

that are highly familiar. We sought to include many signs that are non-polysemous (or with

limited polysemy) and less regionally variant so that they would be unambiguous to most of

our participants. This may also reflect lexicalization processes in sign language lexicons, as it

may be that core native signs tend to develop for frequently encountered phenomena, while

lexical borrowing by means of fingerspelling or lexicalization of classifier constructions is

used for rarer concepts (Brentari & Padden, 2001).

Because we included the same signs on all three tasks, we were also able to examine the

degree of correspondence between AoA, iconicity and familiarity rating scales (also

illustrated as scatterplots in Figure 3). We did so by calculating correlation coefficients upon

the average ratings for each item. The greatest degree of correlation was between AoA and

iconicity ($r= -.463$, $p<.0000001$); early acquired signs tend to be rated as the most iconic[10].

AoA was also highly correlated with familiarity ($r= -.433$, $<.0000001$); early acquired signs

also tend to be more familiar. Contrary to what might be expected, the correlation between

iconicity and familiarity was much lower ($r= +.146$, $p=.011$); there was a reliable tendency for

---

[9] This is true even including the 15 lowest rated items which we excluded from analysis.

[10] This trend seems to contradict claims by Meier (1982; 1987) that children acquiring American Sign Language (ASL) do not acquire iconic signs any earlier than they acquire non-iconic signs, and that children's errors in producing iconic signs are not more iconic than the adult form (Meier, Cheek, & Moreland, 2002).

iconic signs to be more familiar, but this was not particularly strong. This was especially true at the high end of the familiarity scale where many of the most familiar signs are extremely low in iconicity, such as the signs depicted in the middle panels of Figure 1, all with iconicity ratings less than 2.5: BOY (familiarity = 6.35), EASY (6.70), IMPORTANT (6.50) and RIGHT (6.65). This highlights the fact that although iconicity is pervasive in signed languages, many arbitrary (non-iconic) signs are highly familiar and thus probably also frequently occurring.

FIGURE 3 ABOUT HERE

For our age-of-acquisition data, we were also able to compare our data to an independently-obtained data set (Gaynor, Woolfe, & Woll, 2008) which provides an additional measure of reliability. Unlike the present study which asked adults to estimate the age at which they learned a sign, the data collected by Gaynor et al are based on longitudinal testing of children whose parents were asked to complete a checklist of signs which a child comprehends at various ages. From this data set we selected the data from the last report from each deaf child tested (n=34), thus reflecting the greatest extent of language development. The average age at the time of testing was 29.3 months (range: 13-47).

There were 85 signs in common between the two data sets, with an average AoA rating of 7.3 years (range: 3.2 (EAT) - 13.9 (TURTLE)). For each of these signs, we calculated the proportion of children who comprehended and produced each sign at the time of testing. These measures should be negatively correlated with AoA; the more children who comprehend/produce a sign at a given age, the earlier acquired that sign should be. Across these signs the average proportion of comprehension was .61 (range: 0 (DON'T CARE) - .94 (MOTHER)), and for production, .54 (range: 0 (DON'T CARE) - 1.00 (DOG)). We then calculated the correlation between each of these measures and our participants' estimates of AoA. AoA was significantly negatively correlated with both proportion of children who

comprehended each (r = -.526, p < .000001) and with proportion of children who produced

each sign (r = -.499, p < .000001).[11]

Despite the numerous differences in the methodology and populations tested in these

two data sets, these results nicely illustrate a strong degree of correspondence between adults'

estimates of the age at which they acquired a sign, and parents' judgements of what their

children can actually comprehend and produce at a given age.

We provide these norms in the hope that they can prove useful to other researchers of

British Sign Language and other signed languages.

---

[11] Comprehension and production proportions were extremely highly correlated with each
other (r = +.923, p < .000001).

References

Baayen, R. H. (2005) Data mining at the intersection of psychology and linguistics. In Cutler, A. (ed), Twenty-First Century Psycholinguistics: Four Cornerstones, (pp. 69-83). Erlbaum.

Balota, D. A., Cortese, M. J., Sergent-Marshall, S. D., Spieler, D. H., & Yap, M. J. (2004). Visual word recognition of single-syllable words. Journal of Experimental Psychology: General, 133, 283-316.

Balota, D. A., Yap, M. J., Cortese, M. J., Hutchison, K. I., Kessler, B., Loftis, B., Neely, J. H., Nelson, D. L., Simpson, G. B., & Treiman, R. (2007). The English Lexicon Project. Behavior Research Methods, 39, 445-459.

Brentari, D., & Padden, C. A. (2001). Native and foreign vocabulary in American Sign Language: A lexicon with multiple origins. In D. Brentari (Ed.), Foreign vocabulary: A cross-linguistic investigation of word formation (pp. 87-119). Mahwah, NJ: Lawrence Erlbaum Associates.

Brien, D. (Ed.). (1992). Dictionary of British Sign Language/English. Boston: Faber & Faber.

Brysbaert, M. & Ghyselinck, M., (2006). The effect of age of acquisition: Partly frequency-related, partly frequency-independent. Visual Cognition, 13, 992-1011.

Carreiras, M., Gutiérrez-Sigut, E., Baquero, S. & Corina, D. (2008). Lexical processing in Spanish Sign Language (LSE). Journal of Memory and Language, 58, 100-122.

Chiarello, C., Liu, S., Shears, C., & Kacinik, N. (2002). Differential asymmetries for recognizing nouns and verbs: Where are they? Neuropsychology, 16, 35-48.

Cree, G. S., & McRae, K. (2003). Analyzing the factors underlying the structure and computation of the meaning of chipmunk, cherry, chisel, cheese, and cello (and many other such concrete nouns). Journal of Experimental Psychology: General, 132, 163-201

Colombo, L., Pasini, M., & Balota, D.A. (2006). Dissociating the influence of familiarity and meaningfulness from word frequency in naming and lexical decision performance. Memory and Cognition, 34, 1312-1324.

Emmorey, K. (2002). Language, cognition, and the brain: Insights from sign language research. Mahwah, NJ: Lawrence Erlbaum and Associates.

Emmorey, K., & Herzig, M. (2003). Categorical versus gradient properties of classifier construction in ASL. In K. Emmorey (Ed.), Perspectives on classifier constructions in sign languages (pp. 221-246). Mahwah, NJ: Lawrence Erlbaum Associates.

Gaynor, A., Woolfe, T., & Woll, B. (accepted for publication). Early lexical development in British Sign Language, Journal of Deaf Studies and Deaf Education.

Ghyselinck, M., Custers, R., & Brysbaert, M. (2004). The effect of age of acquisition in visual word processing: Further evidence for the semantic hypothesis. Journal of Experimental Psychology: Learning, Memory, and Cognition, 30, 550-554

Gilhooly, K. J., & Logie, R. H. (1980). Age of acquisition, imagery, concreteness, familiarity, and ambiguity measures for 1944 words. Behavior Research Methods and Instrumentation, 12, 395-427.

Johnston, T., & Schembri, A. (2007). Australian Sign Language: An introduction to sign language linguistics. Cambridge: Cambridge University Press.

Lieberth, A. K., & Gamble, M. E. B. (1991). The role of iconicity in sign language learning by hearing adults. Journal of Communication Disorders, 24, 89-99.

McKee, D. & Kennedy, G.D. (2006). The distribution of signs in New Zealand Sign Language. Sign Language Studies, 6, 372-390.

McRae, K., Cree, G. S., Seidenberg, M. S., & McNorgan, C. (2005). Semantic feature production norms for a large set of living and nonliving things. Behavior Research Methods, 37, 547-559

Meier, R. P. (1982). Icons, Analogues and Morphemes: The Acquisition of Verb Agreement in ASL. Unpublished doctoral dissertation, University of California at San Diego, San Diego.

Meier, R. P. (1987). Elicited imitation of verb agreement in American Sign Language: Iconically or morphologically determined? Journal of Memory and Language, 26, 362-376.

Meier, R. P., Cheek, A., & Moreland, C. J. (2002). Iconic versus motoric determinants of the form of children's early signs. In B. Skarabela, S. Fish & A. H.-J. Do (Eds.), Proceedings of the 26th Annual Boston University Conference on Language Development (pp. 393-405). Somerville, MA: Cascadilla Press.

Microbooks. (2005). The Advanced Dictionary of British Sign Language CD-ROM. Sunbury-on-Thames, England: Microbooks.

Morford, J., & MacFarlane, J. (2003). Frequency characteristics of American Sign Language. Sign Language Studies, 3, 213-225.

Schembri, A., Jones, C., & Burnham, D. (2005). Comparing action gestures and classifier verbs of motion: Evidence from Australian Sign Language, Taiwan Sign Language, and nonsigners' gestures without speech. Journal of Deaf Studies and Deaf Education, 10, 272-290.

Slobin, D. I. (1996). From "thought and language" to "thinking to speaking". In J. J. Gumperz & S. C. Levinson (Eds.), Rethinking linguistic relativity (pp. 70-96.). Cambridge: Cambridge University Press.

Snodgrass, J.G., & Vanderwart, M. (1980). A standardized set of 260 pictures: Norms for name agreement, image agreement, familiarity, and visual complexity. Journal of Experimental Psychology: Human Learning and Memory, 6, 174-215.

Stadthagen-Gonzalez, H., & Davis, C. J. (2006). The Bristol norms for age of acquisition, imageability, and familiarity. Behavior Research Methods, 38, 598-605.

Sutton-Spence, R., & Day, L. (2001). Mouthings and mouth gestures in British Sign Language (BSL). In P. Boyes Braem & R. Sutton-Spence (Eds.), The hands are the head of the mouth: The mouth as articulator in sign languages (pp. 69-85). Hamburg: Signum.

Thompson, R., Emmorey, K., & Gollan, T. (2005). Tip-of-the-fingers experiences by ASL signers: Insights into the organization of a sign-based lexicon. Psychological Science, 16, 856-860.

Vigliocco, G., Vinson, D.P., Woolfe, T., Dye, M.W., & Woll, B. (2005). Words, signs and imagery: when the language makes the difference. Proceedings of the Royal Society B, 272, 1859-1863.

Vinson, D.P. & Vigliocco, G. (in press). Semantic feature production norms for a large set of objects and events. Behavior Research Methods.

ARCHIVED MATERIALS
The following materials and links may be accessed through the Psychonomic Society's Norms, Stimuli, and Data Archive, www.psychonomic.org/archive. To access these files or links, search the Archive for this article using the journal (Behavior Research Methods, Instruments, & Computers), the first author's name (VINSON) and the publication year (2008).

FILE: BSL_norming_video.zip
This compressed archive file contains 300 files, each corresponding to one BSL video clip in Quicktime (.MOV) format.

FILE:BSL_norming.txt provides a summary of ratings for each item, tab-delimited text file with column labels in the first row.
Column:
gloss: English translation of the sign. Corresponds to filenames in the BSL_norming_video archive.

AoA_mean: Average age of acquisition (AoA) rating for that sign.
AoA_#: Number of participants (of 20) who gave an AoA rating for that sign.
AoA_DK: Number of participants who responded "don't know" (they did not recognize that sign).
AoA_sd: Standard deviation of AoA ratings for that sign.
AoA_known: Proportion of raters who knew a given sign (i.e., responded other than "don't know").

Icon_mean: Average iconicity rating for that sign.
Icon_#: Number of participants who gave an iconicity rating for that sign.
Icon_DK: Number of participants who responded "don't know".
Icon_sd: Standard deviation of iconicity ratings for that sign.
Icon_known: Proportion of raters who knew a given sign.

Famil_mean: Average familiarity rating for that sign.
Famil_sd: Standard deviation of familiarity ratings for that sign.
Famil_#: Number of participants who rated that sign.

AUTHOR'S E-MAIL ADDRESS: d.vinson@ucl.ac.uk

Appendix. Instructions for the rating tasks.

Instructions for Age of Acquisition Ratings (English version)
For this task we want to know about when you learnt different BSL signs.

Please indicate how old you were when you learnt each of the signs on the list. By learning a sign we mean the age when you would have understood that sign if somebody had used it in front of you, EVEN IF YOU DID NOT use it yourself at the time.

You will see different age categories from birth to adulthood. Please pick the age when you believe you understood each sign. For example if you see the sign MILK, you may have understood this sign at an early age so you would select an early age band 0-2 or 3-4. If you see the sign PSYCHOLOGY, you may have understood this at a much later age, such as 13-14 or 15-16.

An approximate age is good enough for this rating. If you do not know the meaning of a sign, select I DO NOT KNOW THIS SIGN.

Watch each sign and begin rating them at your own speed. Work fairly quickly but do not be careless in your ratings. The important thing is for you to be as accurate as possible.

Feel free to use the entire range of ages, from 0-2 to 17+; at the same time, do not be concerned about how often you select a particular age group, as long as you are honest in your ratings.

Instructions for Iconicity Ratings (English version)
For this task we want to know how iconic you think some BSL signs are. First we will explain what we mean by iconic

Some signs are considered to be iconic; the sign somehow looks like what it means. One sign generally considered to be very iconic is DRINK, which looks like a person holding a cup and bringing it to their mouth. You would be able to guess this sign's meaning even if you did not know BSL. Other signs are not iconic at all; for example the sign BROTHER does not look like a brother. Signs can be motivated in other ways (i.e. there can be a reason why the sign looks the way it does). The sign FATHER clearly is clearly linked to the fingerspelled letter F, but it is not iconic because the sign does not look like what it means (it does not look like a father).

For each sign that you will see, rate on a scale of 1 to 7 how iconic you think the sign is, with 1 as not iconic at all and 7 as highly iconic. For example DRINK is very iconic; it looks just like drinking from a cup, this would be a 7. BROTHER is not at all iconic and would be a 1. Signs that are intermediate in iconicity, of course, should be rated appropriately between the two extremes, for example the sign MAN may have a rating of 3 or 4.

Feel free to use the entire range of numbers, from 1 to 7; at the same time, don't be concerned about how often you use a particular number as long as you are honest in your ratings.

Remember, do not rate fingerspelled signs as iconic just because they resemble the letters of the alphabet used in an English word-try to think how the fingerspelling does or does not look like what it means.

If you do not know the meaning of a sign, choose I DO NOT KNOW THE MEANING OF THIS SIGN. Work fairly quickly but do not be careless in your ratings, the important thing is for you to be as accurate as possible.

Instructions for Familiarity Ratings (English version)
For this task we want to find out how often you see certain BSL signs. You will be given a list of signs and you are to rate each one as to the number of times that you have seen others in the community using it by simply choosing a number on the given 1 to 7 scale.

In this scale, 1 represents NEVER, that is, you have never seen the sign in your life; the number 2 represents RARELY, that is you have seen the sign at least once before, but only rarely and so on until 7, which represents VERY OFTEN, that is, you have seen the sign nearly every day of your life.

For example you may see others use the sign MILK very often so you would select 6 or 7, there may be some rare signs which you do not see very often e.g. the sign NICARAGUA, so you would select 2 or 3.

Do not be bothered if you are not sure of the meaning of some of the signs. Simply rate each one as to the number of times you have seen others use it regardless of its meaning.

Watch each sign and begin rating them at your own speed. Work fairly quickly but do not be careless in your ratings, the important thing is for you to be as accurate as possible.

Some of the signs in this task may be very rare, so you are not expected to have seen all of them. Just make the best estimates you can. Feel free to use the entire range of numbers, from 1 to 7; at the same time, do not be concerned about how often you use a particular number, as long as you are honest in your ratings.

Figure Captions.

Figure 1. Still images from BSL signs. Upper panel: iconic signs (CAMERA, EAT). Second

panel, noniconic signs (BOY, EASY). Third panel, noniconic signs (IMPORTANT, RIGHT).

Lower panel, iconic signs referring to abstract concepts (TIME, THINK).

Figure 2. Frequency histograms reflecting the distribution of ratings for the 300 BSL signs

normed here.

Figure 3. Scatterplots depicting the relations between age of acqusition, iconicity and

familiarity ratings.