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SHORT COMMUNICATION

Swedish and English word ratings of imageability, familiarity and age of acquisition are highly correlated

Frida Blomberg & Carl Öberg

At present, there is no comprehensive psycholinguistic database containing Swedish words with ratings of word properties such as e.g. imageability, although researchers carrying out psycholinguistic studies in Swedish face the need to be able to control for and systematically vary such properties. The present study addressed this issue by investigating the possibility of transferring English word ratings to Swedish. IMAGEABILITY, FAMILIARITY and AGE OF ACQUISITION (AoA) ratings were obtained for a sample of Swedish words (N = 99). These ratings were then compared with the corresponding English ratings from the Medical Research Council (MRC) Psycholinguistic Database (Coltheart 1981) using Spearman correlation. Swedish and English word ratings were found to be highly correlated for imageability and AoA, and moderately correlated for familiarity. Following these results, we suggest that, in general, ratings of these variables can be reliably transferred between the two languages, although some caution should be taken, since for some individual words, some ratings might differ substantially for their Swedish and English translations.

Keywords word ratings, Swedish, English, imageability, age of acquisition, familiarity, psycholinguistics, lexical database construction

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1. INTRODUCTION

1.1 Word properties and psycholinguistic experiments

When different word types, e.g. nouns and verbs, or concrete and abstract words, are compared in psycholinguistic experiments, it is crucial to be able to systematically vary the word properties of interest, while keeping other possibly confounding

variables constant. A frequently used approach for evaluating semantic as well as other word properties is to ask people to make ratings of words' properties on a Likert-type scale. For English, several research groups have gathered word ratings for different properties, among them IMAGEABILITY, CONCRETENESS, FAMILIARITY, SUBJECTIVE FREQUENCY, MEANINGFULNESS and AGE OF ACQUISITION (AoA) (Paivio, Yuille & Madigan 1968, Gilhoolie & Logie 1980, Coltheart 1981, Morrison, Chappell & Ellis 1997, Altarriba, Bauer & Benvenuto 1999, Balota, Pilotti & Cortese 2001, Bird, Franklin & Howard 2001, Stadthagen-Gonzalez & Davis 2006, Cortese & Khanna 2008, Warriner, Kuperman & Brysbaert 2013.[1] Word ratings are also available for a number of other European languages, e.g. Norwegian (Lind et al. 2015), Portugese (Marques et al. 2007) Dutch (Ghyselinck, De Moor & Brysbaert 2000) and French (Flieller & Tournois 1994). However, no similar database with word ratings is currently available for Swedish. Since collection of word ratings is a time-consuming process and a large database of rated words should ideally be available to choose stimuli from, a convenient alternative would be to be able to translate words with ratings from already existing large databases in other languages. However, this method presupposes that word ratings are similar enough across languages for transfer of ratings to be applicable. Even if words are accurately translated, their semantic content is likely to differ more or less subtly between languages (see Simonsen et al. 2013), and it can thus be argued that English word ratings might not accurately reflect the properties of Swedish words.

The present study was carried out in order to obtain a sample of Swedish word ratings for three of the above-mentioned variables (imageability, familiarity and age of acquisition), and to see whether these ratings correlated with corresponding English word ratings. If so, it would be reasonable to assume that directly transferring English word ratings of these properties to Swedish would in general be a valid method.

1.2 Imageability

Concrete words are generally processed with greater speed and accuracy than abstract words (Paivio 2010). Concreteness is related to the amount of sensory information associated with a word and is usually assessed by having subjects rate the words' imageability or concreteness on a 1–7 scale, where 1 = least imageable/concrete and 7 = most imageable/concrete. Whereas concreteness values are based on how directly a word refers to a physical object, imageability ratings are obtained on the basis of judgments of how easily a word evokes a sensory experience or 'mental image' (Paivio et al. 1968; Gillhoolie & Logie 1980; Paivio 1986, 2010). Rated concreteness is highly correlated with rated imageability, and in many studies the two terms are used interchangeably (e.g. Sabsevitz et al. 2005, Fliessbach et al. 2006, Moroschan & Westbury 2009).

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1.3 Familiarity

It is well-known that word processing is affected by how common words are, and word frequencies taken from spoken or written language corpora are often used as an indication of how often a word may have been encountered. Another way to quantify people's experience with words is to ask them to rate how familiar words are on a 1–7 scale where 1 = least familiar and 7 = most familiar (Gilhoolie & Logie 1980). Familiarity ratings can be used as a complement to word frequencies, or be used in cases where word frequencies are not available, but familiarity judgments may also measure something else than just how often the words are encountered, possibly involving semantic properties. For example, Westbury (2013) found that a set of affective predictors accounted for 100% of the variance in English familiarity ratings. In some studies, familiarity has even been found to be a better predictor of word processing performance than word frequency (Stadthagen-Gonzalez & Davis 2006).

1.4 Age of acquisition (AoA)

Early acquired words can be assumed to be processed differently from words acquired later in life, and experience of earlier learned words is likely to be greater than experience of more recently learned words. The AoA variable is quantified on a 1–7 scale, where 1 = lowest age interval (0–2 years of age) and 7 = highest interval (13 years and older) (Gilhoolie & Logie 1980). Making subjective ratings of when a particular word was acquired may seem difficult and imprecise, but AoA estimates have been found to correspond reliably to objective measures of word acquisition age (Stadthagen-Gonzalez & Davis 2006).

2. METHOD

2.1 Participants and materials

Nineteen native Swedish speakers (13 female) in the age range of 19–65 years (M = 38, SD = 15) performed word ratings of imageability, familiarity and age of acquisition for 99 Swedish words. All ratings were performed anonymously. The words were all nouns denoting concrete objects and entities as well as emotions and abstract states (Appendix 1). Written word frequencies were obtained from the Stockholm Umeå Corpus (SUC; Ejerhed et al. 1992). SUC frequencies ranged from 1 to 130 occurrences per million (M = 2.48, SD = 0.914). Word length ranged from one to four syllables (M = 24.3, SD = 28.021).

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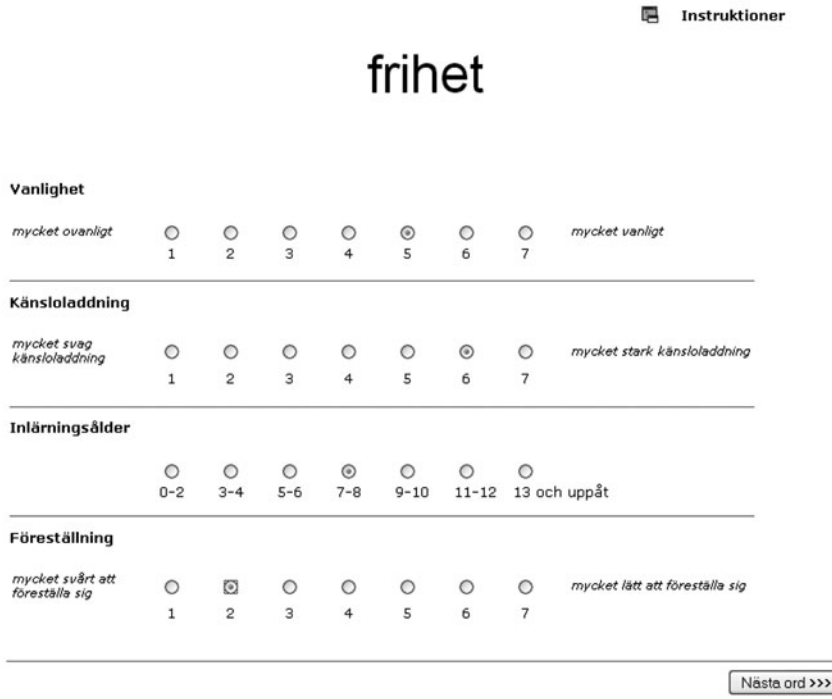

Figure 1. Screenshot of the web-based rating form.

2.2 Procedure

The word rating test was carried out as a web-based rating form (Figure 1), published on an internet page with the MIDAS software (further described in Appendix 2). All words were rated with regard to the variables *föreställning* (imageability), *vanlighet* (familiarity), *inlärningsålder* (age of acquisition) and *känsloladdning* (emotional arousal).[2] Word ratings were made on scales ranging from 1 to 7 (1 = the lowest imageability/familiarity/AoA/arousal, 7 = the highest imageability/familiarity/AoA/arousal), following translated versions of the instructions used in the Gilhoolie–Logie norms (Gilhoolie & Logie 1980), a set of rating norms which the imageability, familiarity and age of acquisition scores in the Medical Research Council (MRC) Psycholinguistic Database scores are partially based on. The words were presented in random order, with one practice word prior to the real ratings. Each word had to be rated for all variables before the next word could be accessed. It was not possible to go back and change any answers. The instructions (Appendix 3, for English instructions see Gilhoolie & Logie 1980) could be viewed

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at any time during the test by clicking the icon *Instruktioner* ('Instructions') at the upper right corner of the web page.

2.3 Data analysis

Scores on the 1–7-point scale were transformed by multiplying them by 100, in order to get values on the same scale as those in the MRC database (100–700). In order to see how similar the Swedish imageability, familiarity and age of acquisition ratings were to the corresponding English word ratings, all words were translated and English word ratings were obtained from the MRC database (Coltheart 1981). The MRC database was chosen since it contains a large number of English words and is easily searchable via a web-based interface.[3] The MRC database value for each English word was compared with the mean rating of each word from the present study using Spearman correlation. Written frequencies (Kucera–Francis) were obtained from the MRC database in order to see whether or not the Swedish and English word frequencies correlated. All statistical testing was performed in SPSS.

3. RESULTS

All Swedish and English words with ratings are listed in Appendix 1. As can be seen in Table 1 and Figures 2–4, all three word properties were significantly correlated between the two languages (all ps $< .001$). Very strong correlations were present for imageability ($r_s = .865$) and age of acquisition ($r_s = .816$) and a moderate correlation was seen for familiarity, ($r_s = .393$). The range of familiarity values was more restricted than the range of the other variables (see Table 1), i.e. the words were generally considered to be rather familiar, possibly contributing to the lower correlation for this variable. Statistical testing with Pearson correlation showed that written word frequencies from the SUC (Ejerhed et al. 1992) and the MRC database (Coltheart 1981) correlated ($r = .473$, $p < .001$)

	Swedish			English			Correlation	
	M	SD	Range	M	SD	Range	Spearman rho	p
Ima	534	98	316–695	483	101	293–655	.865	$< .001$
AoA	417	128	153–674	377	129	203–606	.816	$< .001$
Fam	555	67	363–700	526	51	394–621	.393	$< .001$

Ima = imageability, AoA = age of acquisition, Fam = familiarity

Table 1. Correlations and descriptive statistics of Swedish and English word ratings.

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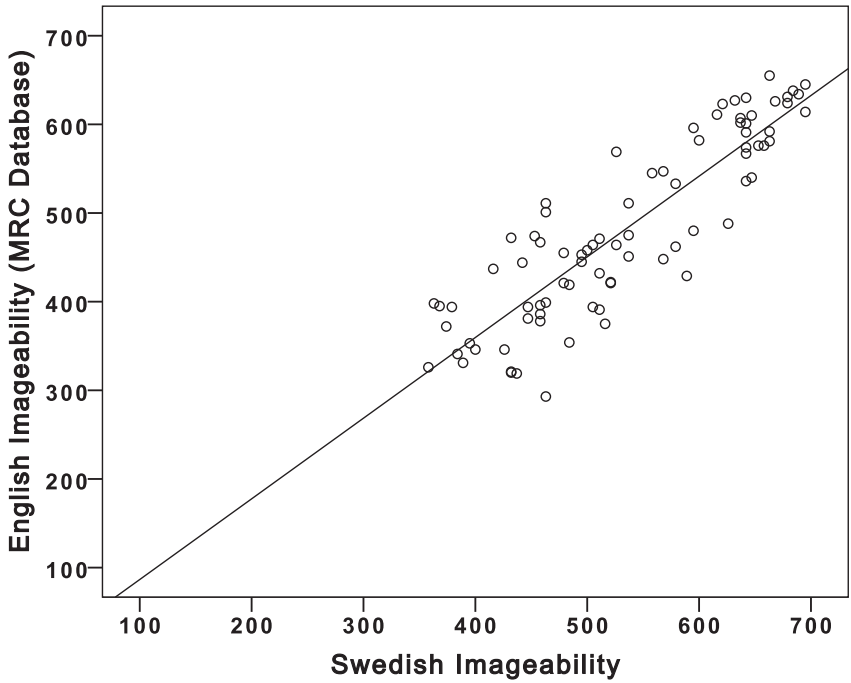

R^2 Linear = 0.776; $y = -4.42+0.91*x$

Figure 2. Scatterplot showing the correlation between English imageability ratings from the MRC database (*y* axis) and Swedish imageability ratings (*x* axis).

4. DISCUSSION

The present study compared subjects' ratings of imageability, familiarity and age of acquisition in a sample of Swedish nouns with the ratings of their English translations in the MRC database. The Swedish word ratings were moderately to strongly correlated with the English ratings, indicating that MRC database values can be reliably transferred to Swedish translations of the words. This opens up the possibility of translating a large number of already available English word ratings and using the Swedish translations of the words for psycholinguistic experiments. It should, however, be noted, that since written word frequencies also correlated between the two languages, this might account for some of the shared variance in word ratings.[4]

Although the present study showed that transferring word ratings is a valid option in the absence of Swedish ratings (and even as a complement to Swedish word ratings if they existed but did not comprise the same set of words), it should be stressed that there would be several advantages of a genuine Swedish database. One advantage would be that, other variables whose values cannot be transferred, such

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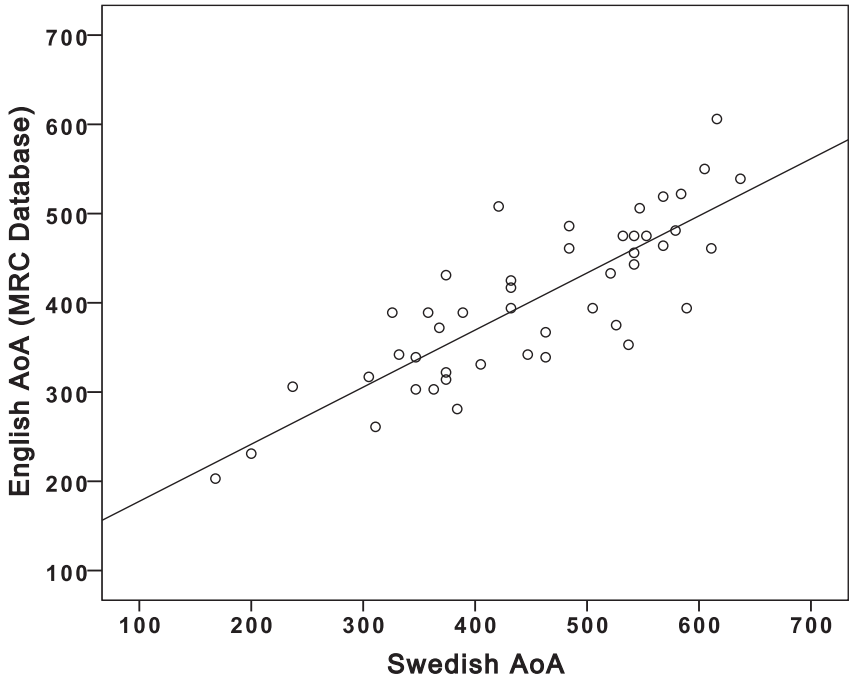

R^2 Linear = 0.684; y = 1.14E2+0.64∗x

Figure 3. Scatterplot showing the correlation between English age of acquisition ratings from the MRC database (*y* axis) and Swedish age of acquisition ratings (*x* axis).

as word frequencies and data concerning form-based word properties, could also be included in such a database. It is also the case that some word meanings (especially highly culture-specific ones) might be difficult to translate and ratings of such words' properties can be expected to differ between languages (Simonsen et al. 2013). In the present study, some words exhibited larger variation between their Swedish and English ratings. Examples of this include the Swedish word *sorg* 'sorrow', which was rated lower in imageability compared to the English word *sorrow* (429 compared to 589), but higher in familiarity (589 compared to 486). Swedish *ilska* 'anger' was rated as being substantially more imageable (626) than English *anger* (488). The Swedish word *position* 'position' had a notably higher AoA rating (526) than its English translation *position* (375). One explanation for this variation might be that these words' meanings do not overlap entirely between the two languages.

Furthermore, there are word properties other than the ones compared in the present study that may be less correlated between the two languages (e.g. meaningfulness, Coltheart 1981) as well as other variables, not available in the MRC database, which it might be useful to have Swedish ratings for (e.g. abstract conceptual features (Crutch et al. 2013). Thus, in the long run it would be ideal to

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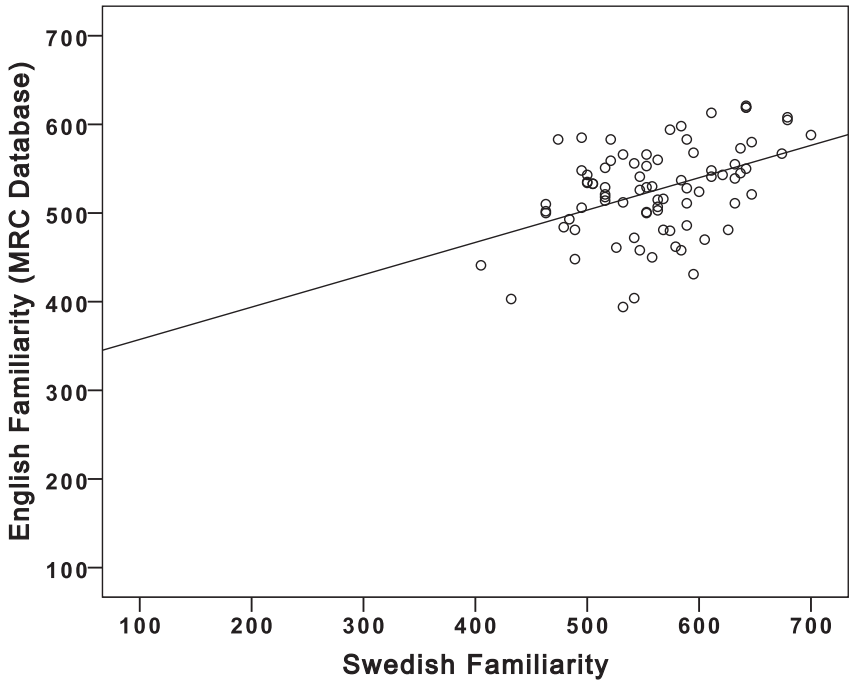

R^2 Linear = 0.192; $y = 3.21E2+0.36*x$

Figure 4. Scatterplot showing the correlation between English familiarity ratings from the MRC database (*y* axis) and Swedish familiarity ratings (*x* axis).

create a Swedish database, preferably searchable via a web-based interface, similar to e.g. the MRC database (Coltheart 1981) and Norwegian Words (Lind et al. 2015).

Finally, Swedish and English are structurally similar languages, spoken in similar cultures. Thus, although the results offer support for transferring word ratings between these two languages, they might be less generalizable for translations across less similar languages and cultures. The field would benefit from extending the cross-linguistic comparisons to other languages. Swedish ratings could be compared to those already available in, for example, Norwegian, French, Dutch and Portugese and, ideally, also to word ratings in languages outside of the Indo-European language family.

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APPENDIX 1

Words with ratings

Ima = imageability, Fam = familiarity, AoA = age of acquisition, Emo = emotional arousal; Swe = Swedish, Eng = English

CONCRETE Swedish	English	Ima Swe	Ima Eng	Fam Swe	Fam Eng	AoA Swe	AoA Eng	Emo Swe
Fönster	Window	637	602	642	621	200	231	216
Klocka	Clock	695	614	679	608	195	—	226
Telefon	Telephone	663	655	679	605	195	—	268
Roman	Novel	568	547	558	530	553	475	337
Eld	Fire	689	634	647	580	205	—	400
Stuga	Cottage	637	607	621	543	268	—	295
Mjölk	Milk	684	638	700	588	153	—	300
Soffa	Couch	642	536	647	521	200	—	263
Cigarett	Cigarrette	695	645	637	573	289	—	395
Uniform	Uniform	642	591	479	484	405	331	479
Silver	Silver	600	582	589	528	305	317	295
Kamera	Camera	653	576	642	550	263	—	258
Dragspel	Accordion	658	576	532	394	353	—	295
Varg	Wolf	647	610	584	537	405	—	342
Madrass	Mattress	642	601	600	524	274	—	242
Paraply	Umbrella	663	592	632	511	237	306	237
Diamant	Diamond	621	623	532	512	347	339	332
Fjäril	Butterfly	679	624	626	481	205	—	405
Näckros	Waterlily	668	—	458	—	379	—	295
Persilja	Parsley	663	—	579	—	389	—	279
Kameleont	Chameleon	511	—	363	—	511	—	242
Papegoja	Parrot	658	—	558	—	258	—	247
Tegelsten	Brick	642	574	553	529	311	261	168
Jordgubbe	Strawberry	679	631	632	539	189	—	421
Termometer	Thermometer	663	581	568	481	326	389	237
Vulkan	Volcano	632	627	526	461	363	—	432
Purjolök	Leek	647	540	595	431	389	389	242
Gräshoppa	Grasshopper	642	630	563	507	274	—	205
Humla	Bumblebee	647	—	616	—	226	—	295
Apelsin	Orange	668	626	674	567	168	203	237
Hasselnöt	Hazelnut	611	—	547	—	358	—	221
Blomkål	Cauliflower	642	567	579	462	347	—	211
Påsklilja	Daffodil	616	611	542	404	379	—	311

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ABSTRACT Swedish	English	Ima Swe	Ima Eng	Fam Swe	Fam Eng	AoA Swe	AoA Eng	Emo Swe
Tradition	Tradition	484	354	547	526	484	486	411
Frihet	Freedom	416	437	595	568	432	425	616
Position	Position	426	346	521	559	526	375	253
Kombination	Combination	358	326	484	493	542	475	132
Reaktion	Reaction	368	395	505	533	547	506	289
Variation	Variety	374	372	505	533	568	464	237
Fest	Party	595	596	642	619	347	—	453
Hemlighet	Secret	453	—	600	—	284	—	505
Attityd	Attitude	432	321	553	553	579	481	405
Rykte	Rumour	395	353	563	503	484	461	447
Ideal	Ideal	389	331	516	521	611	461	463
Löfte	Promise	432	320	584	598	395	—	553
Moral	Morale	384	341	500	535	637	539	547
Ritual	Ritual	453	474	432	403	589	—	337
Favorit	Favourite	458	378	574	594	363	303	453
Plikt	Duty	400	346	500	543	563	—	400
Datum	Date	463	501	611	613	374	314	200
Kaos	Chaos	526	464	558	450	526	—	542
Överflöd	Abundance	458	386	489	448	568	519	395
Mysterium	Mystery	432	548	495	472	447	342	432
Ironi	Irony	463	293	547	458	616	606	495
Önskning	Wish	463	399	542	556	326	—	474
Spekulation	Speculation	316	—	437	—	637	—	300
Prestige	Prestige	379	394	405	441	674	—	442
Uppehåll	Break	363	398	516	529	500	—	268
Mognad	Maturity	400	—	521	—	526	—	363
Charm	Charm	479	455	516	514	542	456	474
Magi	Magic	500	458	489	481	384	281	432
Visdom	Wisdom	447	381	463	510	532	475	342
Gästfrihet	Hospitality	416	—	421	—	584	—	395
Välgörenhet	Charity	495	445	516	518	521	433	442
Påhitt	Idea	437	319	495	585	379	—	400
Lydnad	Obedience	447	394	463	500	374	—	463
EMOTION Swedish	English	Ima Swe	Ima Eng	Fam Swe	Fam Eng	AoA Swe	AoA Eng	Emo Swe
Kärlek	Love	526	569	642	619	347	303	653
Glädje	Joy	579	533	637	545	332	342	663
Oro	Anxiety	521	422	611	548	442	—	611
Sorg	Sorrow	589	429	589	486	432	394	663
Lycka	Happiness	547	—	621	—	374	—	632
Spänning	Excitement	500	—	574	—	400	—	532

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Lust	Lust	442	444	542	472	474	—	542
Längtan	Yearning	532	—	521	—	379	—	605
Humor	Humour	579	462	542	555	432	417	542
Skräck	Horror	558	545	553	501	368	372	632
Tröst	Comfort	479	421	532	566	479	—	447
Skam	Shame	484	419	500	534	463	367	626
Förvåning	Surprise	537	451	589	583	374	322	463
Ilska	Anger	626	488	611	541	353	—	658
Besvikelse	Disappointment	505	—	600	—	432	—	605
Nyfikenhet	Curiousity	505	394	563	515	358	389	479
Stress	Stress	558	—	637	—	505	—	621
Lättnad	Relief	511	432	516	551	542	443	547
Chock	Shock	695	471	637	560	289	—	395
Irritation	Irritation	568	448	605	470	421	508	584
Entusiasm	Enthusiasm	505	464	495	506	584	522	484
Passion	Passion	458	467	463	502	611	—	553
Förälskelse	Crush	595	480	574	480	463	339	611
Depression	Depression	495	453	547	541	605	550	563
Njutning	Pleasure	537	511	521	583	505	394	574
Medlidande	Pity	511	391	568	516	537	353	579
Avundsjuka	Envy	516	375	589	511	374	431	595
Svartsjuka	Jealousy	537	475	553	500	479	—	605
Trivsel	Comfort	479	421	532	566	479	—	447
Tacksamhet	Gratitude	458	396	584	458	474	—	553
Välbehag	Pleasure	537	511	521	583	505	394	574
Avsmak	Disgust	495	—	395	—	605	—	489
Rastlöshet	Restlessness	505	—	484	—	553	—	442

APPENDIX 2

Method for data collection and database construction

The present study was carried out using the software MIDAS (Mysql Interface and Database Abstraction System). MIDAS is a web content and database management system which can be used to gather various sources of linguistic data and make them easily accessable and searchable through a common interface where search criteria for various parameters, e.g. word frequency, word class and other variables can be specified. MIDAS was used for creating the word rating web page as well as for organizing the data. With MIDAS, all data entered into the system can be downloaded as a .csv-file and directly imported to SPSS for statistical testing.

Word frequencies were obtained from the Stockholm Umeå Corpus (SUC) (Ejerhed et al. 1992) and the Gothenburg Spoken Language Corpora (GSLC) (Alwood 1999), the number of syllables for each word was manually counted, and this information was entered into the database together with data from the MRC database and the word ratings obtained in the present study. In this way, a mini-database was constructed. For access to the database, please contact the first author of the present study: frida.blomberg@ling.lu.se.

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APPENDIX 3

Swedish instructions

Instruktioner

Du kommer att få poängsätta ett antal ord gällande några olika egenskaper. En skala med 7 steg kommer att användas i samtliga fall. Känn dig fri att använda hela skalan, men bry dig inte om hur ofta du använder en viss siffra så länge den motsvarar din verkliga bedömning av ordet. Det är inte meningen att du ska lägga ner lång tid på varje fråga – fyll i testet ganska snabbt och baserat på din intuition, men reflektera ändå över frågorna innan du svarar. Observera också att det inte finns några "rätt" eller "fel" svar, utan syftet med testet är att du ska ge en bild av hur du uppfattar orden.

Här kommer ordegenskaperna som du kommer att bedöma:

1) Vanlighet Det varierar hur vanliga olika ord är, dvs hur ofta de förekommer i vardagen och hur välbekanta de känns. En del ord är mycket välbekanta, medan andra kan vara mindre välbekanta eller nästan helt okända. Din uppgift är att poängsätta ordens vanlighet, beroende på hur vanliga du upplever att de är. Skalan sträcker sig från 1–7, där **1 är mycket ovanligt** och **7 är mycket vanligt**. De ord som du upplever som mycket vanliga ska alltså ges en hög vanlighetspoäng. De ord som du upplever som mycket ovanliga ska ges en låg vanlighetspoäng.

2) Känsloladdning Det varierar hur starkt olika ord är associerade med känsloupplevelser. En del ord väcker inre känslor som kan vara starkt positiva eller negativa, andra ord kan väcka mindre tydliga känsloupplevelser, och ytterligare ord är helt neutrala och väcker ingen känsloupplevelse alls. Din uppgift är att poängsätta ordens känsloladdning, beroende på hur starka känslor de väcker. Skalan sträcker sig mellan 1–7, där **1 motsvarar ett helt neutralt ord** och **7 ett starkt känsloladdat ord**. De ord som väcker starka känsloassociationer ska ges en hög känsloladdningspoäng. De ord som i mycket liten utsträckning eller inte alls väcker känsloassociationer ska ges en låg känsloladdningspoäng.

3) Inlärningsålder I vilken ålder kan du uppskattningsvis ha lärt dig ordet? En skala med 7 åldersintervall kommer att användas. Intervallen är **0–2 år**, **3–4 år**, **5–6 år**, **7–8 år**, **9–10 år**, **11–12 år** samt **13 år och uppåt**.

4) Föreställningar Det varierar hur lätt olika ord väcker inre föreställningar av t.ex. saker, händelser eller upplevelser. En del ord väcker snabbt och lätt **föreställningar av synintryck, ljudintryck, känselintryck, lukter och smaker**, medan andra ord kan göra det med viss ansträngning (t.ex. efter en lång fördröjning) och vissa ord väcker inte någon inre föreställning alls. Din uppgift är att poängsätta orden beroende på hur lätt de väcker inre föreställningar. Skalan sträcker sig mellan 1–7, där **1 är svårast att föreställa sig** och **7 är lättast att föreställa sig**. De ord som snabbt och lätt väcker inre föreställningar ska ges en hög föreställbarhetspoäng. De ord som med svårighet eller inte alls väcker inre föreställningar ska ges en låg föreställbarhetspoäng.

NOTES

1. There are also studies that aim to computationally extrapolate estimates for the whole dictionary from human word ratings (Westbury et al. 2013).

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2. This variable was not compared to English, since the MRC database does not contain values for emotional arousal, but the values are nevertheless reported in Appendix 1. A 1–7 point scale similar to that for the other variables was created for emotional arousal for the present study with 1 = least emotionally arousing and 7 = most emotionally arousing.
3. The MRC database can be accessed via a web-based interface (http://websites.psychology.uwa.edu.au/school/MRCDatabase/uwa_mrc.htm), where the preferred range of values of different variables can be specified and word lists are given as output. It is also possible to download the entire MRC database free of charge.
4. We would like to thank an anonymous reviewer for pointing this out.

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