C E N T E R   F O R   R E S E A R C H   I N   L A N G U A G E

May 2000 **Vol. 12, No. 1**

The Newsletter of the Center for Research in Language, University of California, San Diego, La Jolla CA 92093
Tel: (858) 534-2536 • E-mail: info@crl.ucsd.edu • WWW: http://www.crl.ucsd.edu/newsletter

• • •

FEATURE ARTICLE

Introducing the CRL International Picture-Naming Project (CRL-IPNP)

English: Elizabeth Bates, Kara Federmeier, Dan Herron, Gowri Iyer
University of California, San Diego

German: Thomas Jacobsen, Thomas Pechmann
University of Leipzig

Italian: Simona D'Amico, Antonella Devescovi
University of Rome "La Sapienza"

Spanish: Nicole Wicha, Araceli Orozco-Figueroa
University of California, San Diego &
Universidad Autonóma de Baja California

Spanish-English Bilinguals: Kathryn Kohnert, Gabriel Gutierrez
San Diego State University &
University of California, San Diego

Chinese: ChingChing Lu, Daisy Hung, Jean Hsu, Ovid Tzeng
Yang Ming University, Taipei

Bulgarian: Elena Andonova, Irina Gerdjikova, Teodora Mehotcheva
New Bulgarian University, Sofia

Hungarian: Anna Székely, Csaba Pléh
Eotvos Lorand University, Budapest & University of Szeged

EDITOR'S NOTE

This newsletter is produced and distributed by the **CENTER FOR RESEARCH IN LANGUAGE**, a research center at the University of California, San Diego that unites the efforts of fields such as Cognitive Science, Linguistics, Psychology, Computer Science, Sociology, and Philosophy, all who share an interest in language. We feature papers related to language and cognition distributed via the World Wide Web) and welcome response from friends and colleagues at UCSD as well as other institutions. Please visit our web site at `http://www.crl.ucsd.edu`.

SUBSCRIPTION INFORMATION

If you know of others who would be interested in receiving the newsletter, you may add them to our email subscription list by sending an email to `majordomo@crl.ucsd.edu` with the line "`subscribe newsletter <email-address>`" in the body of the message (e.g., `subscribe newsletter jdoe@ucsd.edu`).

Please forward correspondence to:

Ayse Pinar Saygin, Editor
Center for Research in Language, 0526
9500 Gilman Drive, University of California, San Diego 92093-0526
Telephone: (858) 534-2536 • E-mail: editor@crl.ucsd.edu

Back issues of this newsletter are available from CRL in hard copy as well as soft copy form. Papers featured in previous issues include the following:

Analogic and Metaphoric Mapping in Blended Spaces: Menendez Brothers Virus
Seana Coulson
Cognitive Science, UCSD
Vol. 9, No. 1, February 1995

In Search of the Statistical Brain
Javier Movellan
Department of Cognitive Science, UCSD
Vol. 9, No. 2, March 1995

Connectionist Modeling of the Fast Mapping Phenomenon
Jeanne Milostan
Computer Science and Engineering, UCSD Vol. 9, No. 3, July 1995

Representing the Structure of a Simple Context-Free Language in a Recurrent Neural Network: A Dynamical Systems Approach
Paul Rodriguez Department of Cognitive Science, UCSD Vol. 10, No. 1, October 1995

A Brain Potential Whose Latency Indexes the Length and Frequency of Words
Jonathan W. King
Cognitive Science, UCSD
Marta Kutas
Cognitive Science and Neurosciences, UCSD
Vol. 10, No. 2, November 1995

Bilingual Memory: A Re-Revised Version of the Hierarchical Model of Bilingual Memory
Roberto R. Heredia
Center for Research in Language, La Jolla, CA
Vol. 10, No. 3, January 1996

Development in a Connectionist Framework: Rethinking the Nature-Nurture Debate
Kim Plunkett
Oxford University
Vol. 10, No. 4, February 1996

Rapid Word Learning by 15-Month-Olds under Tightly Controlled Conditions
Graham Schafer and Kim Plunkett
Experimental Psychology, Oxford University
Vol. 10, No. 5, March 1996

Learning and the Emergence of Coordinated Communication
Michael Oliphant and John Batali
Department of Cognitive Science, UCSD
Vol. 11, No. 1, February, 1997

Contexts That Pack a Punch: Lexical Class Priming of Picture Naming
Kara Federmeier and Elizabeth Bates
Cognitive Science, UCSD
Vol. 11, No. 2, April, 1997

Lexicons in Contact: A Neural Network Model of Language Change
Lucy Hadden
Department of Cognitive Science, UCSD
Vol. 11, No. 3, January, 1998

On the Compatibility of CogLexicons in Contact: A Neural Network Model of Language Change
Mark Collier
Department of Philosophy, UCSD
Vol. 11, No. 4, June, 1998

Analyzing Semantic Processing Using Event-Related Brain Potentials
Jenny Shao
Department of Speech Pathology, Northwestern University
Helen Neville
Department of Psychology, University of Oregon
Vol. 11, No. 5, December 1998

Blending and Your Bank Account: Conceptual Blending in ATM Design
Barbara E. Holder
Department of Cognitive Science, UCSD
Vol. 11, No. 6, April 1999

Could Sarah Read the Wall Street Journal?
Ezra Van Everbroeck
Department of Linguistics, UCSD
Vol. 11, No. 7, November 1999

CRL Newsletter, Vol. 12 No. 1, May, 2000

Introducing the CRL International Picture-Naming Project (CRL-IPNP)*

English: Elizabeth Bates, Kara Federmeier, Dan Herron, Gowri Iyer
University of California, San Diego

German: Thomas Jacobsen, Thomas Pechmann
University of Leipzig

Italian: Simona D'Amico, Antonella Devescovi
University of Rome "La Sapienza"

Spanish: Nicole Wicha, Araceli Orozco-Figueroa
University of California, San Diego &
Universidad Autonóma de Baja California

Spanish-English Bilinguals: Kathryn Kohnert, Gabriel Gutierrez
San Diego State University &
University of California, San Diego

Chinese: ChingChing Lu, Daisy Hung, Jean Hsu, Ovid Tzeng
Yang Ming University, Taipei

Bulgarian: Elena Andonova, Irina Gerdjikova, Teodora Mehotcheva
New Bulgarian University, Sofia

Hungarian: Anna Székely, Csaba Pléh
Eotvos Lorand University, Budapest & University of Szeged

Abstract

The UCSD Center for Research in Language is engaged in a large international study to provide norms for picture naming (both names produced and reaction times) in seven different languages (English, German, Italian, Spanish, Chinese, Bulgarian, Hungarian) as well as a separate sample of bilinguals (Spanish-English). For all languages, norms have been obtained for 520 line drawings of common objects. For a subset of the languages, norms are being collected for another 275 line drawings of actions. Here we present an overview of the methodology, some preliminary results, and a discussion of plans for publication. A cross-language data base, organized by items, will soon be available on the CRL website, including results of the norming study itself together with available lexical information (frequency, age of acquisition, etc.) for the associated target names.

Picture naming is a widely used technique for the investigation of lexical retrieval, in normal children and adults, and in various clinical populations. Timed studies of picture naming were among the first paradigms ever used to study real-time language processing, from early studies by Cattell (1886), through the pioneering work of Snodgrass and colleagues (Sanfeliu & Fernandez, 1996; Snodgrass & Vanderwart, 1980; Snodgrass & Yuditsky, 1996), to recent studies investigating covert picture naming using functional magnetic resonance imaging (Hernandez, Martinez, & Kohnert, in press; Hernandez, Martinez, Wong, Frank, & Buxton, 2000; Perani et al., 1999) and event-related brain potentials (Schmitt, Münte, & Kutas, in press; van Turennout, Hagoort, & Brown, 1997, 1998, 1999).

The CRL International Picture-Naming Project represents an effort to adapt this technique for use in cross-linguistic studies of lexical access: both recognition (picture-word verification) and retrieval (picture naming), in isolation and in phrase and sentence contexts, in behavioral studies and in functional neural imaging paradigms, across age levels and across clinical populations. Object-naming norms (including both naming and latency) have been obtained for 520 black-and-white drawings of common objects, in seven different languages: American English, Spanish, Italian, German, Bulgarian, Hungarian, and Mandarin Chinese. Action-naming norms are also available (or nearly complete) for 275 drawings of transitive and intransitive actions, in English, Spanish, Bulgarian, Italian and Chinese. In addition, both object and action norms have been collected for Spanish-English bilinguals, in both their languages.

Theoretical Rationale

The rationale for this project is theoretical as well as methodological. The idea was born in 1997 at the Center for Research in Language , when several of us were trying to design a cross-linguistic study comparing the effects of gender cues on lexical access in Italian, Spanish and German. We had already demonstrated in prior studies (e.g. Bates et al., 1996; Bentrovato, Devescovi, D'Amico, & Bates, 1999; Hillert & Bates, 1996; Jacobsen, 1999; Wicha, Hernandez, Reyes, Gavaldón de Barreto, & Bates, under review) that a gender-marked adjective or determiner can facilitate (if it is congruent) or inhibit (if it is incongruent) reaction times to name pictures or to carry out other lexical retrieval operations (e.g. cued shadowing, where auditory target words are repeated; gender monitoring, where target nouns are classified according to their gender; visual word reading). However, based on predictions of the Competition Model (Bates & MacWhinney**,** 1989), we were interested in determining whether the relatively strong and unambiguous gender cues of Italian and Spanish would have larger and more reliable effects on lexical retrieval, compared with gender cues in German (which can be ambiguous out of context, varying with case). It quickly became clear to us that a study of this sort would be difficult to interpret in the absence of systematic norming information about the "nameability" of these same pictures in each language, with no linguistic context at all. The norming project was launched initially for these three languages, but its utility for other languages soon became apparent, and the list of languages and collaborators grew to its present size.

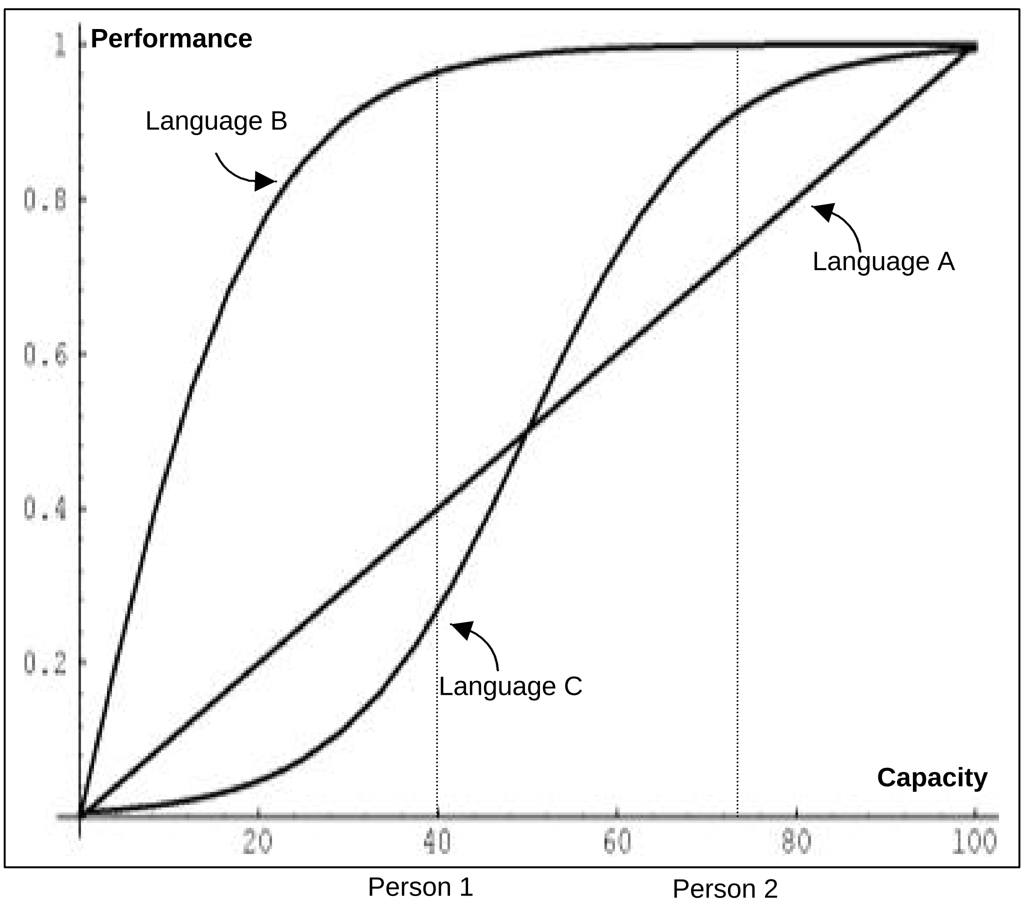
Why would we expect systematic differences in picture naming, aside from cultural differences that are of limited interest for psycholinguistic theories? It is of course well known that languages can vary *qualitatively*, in the presence/absence of specific linguistic features that are relevant for lexical access (e.g. Chinese has lexical tone, Russian has nominal case markers, English has neither). In addition, languages can vary *quantitatively*, in the shape and magnitude of the lexical, phonological and grammatical challenges posed by equivalent structures for real-time processing and learning. For example, it is well known that the "same" lexical item (translation equivalents, names for the same pictures) can vary in frequency from one language to another. Cross-linguistic differences in frequency have also been demonstrated at the grammatical level. For example, passives are rare in English, but extremely common in Sesotho, and relative clause constructions are less common in English than Italian. These differences in frequency are associated with earlier acquisition for passives in Sesotho (Demuth, 1990), and with earlier and greater use of relative clauses in Italian (Bates & Devescovi, 1989), compared to acquisition and use of the same structures in English.

Holding frequency constant, equivalent lexical, phonological and/or grammatical structures can also vary in their reliability ("cue validity") and processibility ("cue cost"). These two constructs figure prominently in the Competition Model (Bates & MacWhinney 1989, MacWhinney 1987), a theoretical framework developed explicitly for cross-linguistic research on acquisition, processing and aphasia. Like other interactive-activation or constraint-based theories, the Competition Model assumes parallel processing, with detailed and bidirectional interactions among different information types. Within this framework, cue validity refers to the *information value* of a given phonological, lexical, morphological or syntactic form within a particular language, while cue cost refers to *the amount and type of processing* associated with the activation and deployment of that form (e.g. perceivability, salience, neighborhood density vs. structural uniqueness, demands on memory, demands on speech planning and articulation). In the seven languages included in the CRL-IPNP data base, there are powerful lexical and grammatical contrasts that have important implications for cue validity and cue cost in word retrieval. These include (1) presence/absence of word order flexibility, which influences the predictability of form class (and hence lexical identity) when words are retrieved in a sentence context, (2) subject and object omission (which also influence the predictability of form class), and (3) presence/absence of morphophonological cues to the identity of an upcoming word, including grammatical gender (in Spanish, Italian, German, Bulgarian), vowel harmony (in Hungarian), and noun classifiers (in Chinese). These languages also vary markedly in aspects of word structure that influence the speed and accuracy of word retrieval. For example, more than 80% of all word types in Chinese are compounds, made up of two or more syllables that occur in many other Chinese words. At the opposite end of the spectrum, compounding is relatively uncommon in Spanish or Italian, with the other languages falling in between. The languages in our data set also vary in the amount of lexical homophony that they permit and/or tolerate, and in the number of different inflected forms that the lexical target might take.

Some of these differences are straightforward and transparent. Other differences might be much more difficult to predict, but could still have a powerful impact on word retrieval, in and out of context. These would include quantitative differences in cue cost and associated performance profiles (for acquisition, breakdown or processing) that reflect the relationship between performance and capacity in a given domain. The key insight here lies in what Norman and Shallice (1980) call "performance/capacity curves" (first discussed in detail by Shallice, 1988; see also Appelbaum, Bates, Pizzamiglio, & Salcedo, 2000; Bates, Appelbaum, & Allard, 1991a; Bates, MacDonald, MacWhinney, & Appelbaum, 1991b; Elman et al., 1996, Chapter 4; Vallar, 1999).

Figure 1 illustrates three hypothetical relationships between performance on a lexical task (e.g. verb retrieval in sentence production) and some underlying capacity or resource (e.g. attention, working memory), in three different languages (A, B and C).

Figure 1: **Hypothetical relationships between lexical performance in three languages, and some underlying processing capacity that they all have in common.**



Let us suppose that the relationship between verb retrieval and attentional resources in Language A is governed by a linear performance/resource function in which a 10% drop in capacity leads to a 10% drop in performance, a 50% drop in capacity leads to a 50% drop in performance, etc. In Language B, the relation between attention and verb production is governed instead by a common nonlinear function for well-practiced tasks in which performance remains near ceiling until a substantial 60% of capacity is lost, and then drops sharply. For Language C, performance and capacity in the same domain follow a more complex S-shaped function that is also quite common in the literature on attention and performance. In this third case, decrements in capacity up to 30% have virtually no measurable effect on verb retrieval, but performance drops rapidly after 30% and then slows down again around 70%.

Given these three hypothetical functions, consider the contrasts that we might observe in each language in Person 1 (an aphasic patient, or perhaps a normal child, who is operating at only 40% capacity) and Person 2 (perhaps a normal adult in an informal situation who is currently operating at 75% capacity). In Language B (which hits ceiling at relatively low attention demands), there is no measurable difference in verbal retrieval between our two hypothetical subjects. In Languages A and C, by contrast, the difference in lexical retrieval between our two subjects is very large. But there is a further effect lurking in Figure 1: for an adult operating at 75% capacity, verb retrieval would be better if he spoke Language C (i.e. C is easier), but for a child operating at 40% capacity, verb retrieval would be better if he spoke Language A (i.e. A is easier).

These are hypothetical language differences. At present, virtually nothing is known about the actual performance-capacity curves that govern different aspects of lexical access in different languages (or, for that matter, in English). However, for all the reasons outlined above (cross-language differences in word structure, lexical ambiguity, inflectional complexity, grammatical predictability), there are solid reasons to predict differences of this kind. We cannot pretend to solve problems of this complexity and magnitude with a simple (albeit enormous) norming study, but we can develop some of the tools required to tackle these issues in future studies. For the remainder of this paper, we introduce the methodology employed in the CRL-IPNP, followed by a preview of early results and of the analyses that have been undertaken so far.

TABLE 1: SOURCES OF OBJECT-NAMING STIMULI

Study	Source	Number of items
PN-Object	**Snodgrass & Vanderwart,1980**	**174**
	Alterations of Snodgrass & Vanderwart	**2**
	Peabody Picture Vocabulary Test, 1981	**10**
	Martinez VA (Dronkers)	**99**
	Abbate & La Chapelle “Pictures Please”, 1984	**168**
	Max Planck Institute for Psycholinguistics	**20**
	Boston Naming Test, 1983	**5**
	Oxford “One Thousand Pictures”	**25**
	Miscellaneous	**17**
PN-Action	**Action Naming test, 1986**	**27**
	Peabody Picture Vocabulary Test, 1981	**57**
	Abbate and La Chapelle “Pictures Please”, 1984	**92**
	Oxford “One Thousand Pictures”	**89**
	Miscellaneous	**10**

Method

Participants. All participants in both the object- and action-naming studies are native speakers (though amounts of second-language experience may vary with the culture), college students who were tested individually in a university setting (San Diego, Leipzig, Rome, Tijuana, Taipei, Sofia, Budapest). For the object-naming studies, there are 50 participants per language in English, Spanish, Italian, Mandarin Chinese, Hungarian and Bulgarian; 30 participants were tested in German. For the action-naming studies, there are 50 subjects each in English, Spanish and Chinese (action-naming data collection is still underway for Italian and Hungarian). A subset of the participants in the action-naming studies also participated in object naming. Additional object- and action-naming data are also available for Spanish-English bilinguals, including 30 tested in a within-subjects design (half of the stimuli in each language, in counterbalanced lists and counterbalanced orders of testing), and 60 tested in a between-subjects design (30 in English, 30 in Spanish, based on random assignment).

Materials Picture stimuli for object naming were black-and-white line drawings of common objects (from various sources -- Table 1), including 174 pictures from the original Snodgrass & Vanderwart set. Stimuli for action naming were another 275 line drawings of familiar transitive and intransitive actions. All stimuli were scanned and stored digitally for presentation within the PsyScope Experimental Control Shell, in 10 different randomized orders.

Procedure. All participants were tested individually, in a quiet room. They were instructed to name the pictures that would appear on the screen as quickly as they could without making a mistake, and to avoid coughs, false starts, hesitations (e.g.”uhmm”), articles or any other extraneous material (e.g. ”a dog” or ”That’s a dog”) other than the best and shortest name they could think of for the depicted object or action). To familiarize participants with the experiment, a practice set of pictures depicting geometric forms like a triangle, a circle, and a square were given as examples. The practice items could be repeated if the experimenter felt that the participant did not yet understand the procedure.

During testing, participants wore headphones with a sensitive built-in microphone (adjusted to optimal distance from the participant’s mouth) that were connected to the Carnegie Mellon button box, a measuring device with 1-ms resolution design for use with Macintosh computers. Response times were collected by a voice key using the CMU button box, which was connected to the computer. The PsyScope Experimental Shell, a program developed to administer experimental presentation (presentation of stimuli, storing data, recording time and response, etc.) was used (Cohen, MacWhinney, Flatt, & Provost, 1993). On each trial, the target picture remained on the screen for a maximum of 3 seconds (3000 ms). The picture disappeared from the screen as soon as a vocal response was registered by the voice key. If there was no response, the picture disappeared after 3000 ms but another 1000 ms was added to the total response window just in case speakers initiated a response right before the picture disappeared. Hence the total window within which a response could be made was 4000 ms. The period between offset of one trial and onset of the next was set to vary randomly between 1000 and 2000 ms. This kind of intertrial “jitter” served to prevent subjects from settling into a response rhythm that is independent of item difficulty.

Scoring. Our scoring criteria were modeled closely on procedures adopted by Snodgrass and Vanderwart (1980), with a few exceptions. The target name for each picture was determined empirically, in two steps.

First, the data were subjected to error coding to determine which responses could be retained for both naming and RT analyses. Three error codes were possible:

1. Valid response refers to all the responses with a valid (codable) name and usable, interpretable response times (no coughs, hesitations, false starts, or prenominal verbalization like “that’s a ball”).

2. Invalid response refers to all the responses with an invalid RT (i.e. coughs, hesitations, false starts, prenominal verbalizations) or a missing RT (the participant did produce a name, but it failed to register with the voice key).

3. Nonresponse refers to any trial in which the participant made no verbal response of any kind.

Only the valid responses were used for determining the target name, and for further analyses. Once the set of valid responses had been determined, the target name was defined as the “dominant response”, i.e. the name that was used by the largest number of subjects.

Second, all valid responses were coded into different lexical categories in relation to the target name, using the same criteria adopted for the adult study. Examples are provided in English (although they are of course realized differently in the other participating languages).

Lexical Code 1: The target name (dominant response, empirically derived).

Lexical Code 2: Any morphological alteration of the target name, defined as a variation that shares the word root or a key portion of the word without changing the word's core meaning. Examples would include diminutives (e.g. 'bike' for 'bicycle'; 'doggie' for 'dog'), plural/singular alternations (e.g. 'cookies' when the target word was 'cookie'), reductions (e.g. 'thread' if the target word was 'spool of thread') or expansions (e.g. 'truck for firemen' if the target word was

Lexical Code 3: Synonyms for the target name (which differ from Code 2 because they do not share the word root or key portion of the target word). Example might include 'couch' for 'sofa' or 'chicken' for 'hen.'

Lexical Code 4: This category was used for all names that could not be classified in codes 1-3, including hyponyms (e.g. 'animal' for 'dog'), semantic associates that share the same class but do not have the target word's core meaning (e.g. 'cat' for 'dog'), part-whole relations at the visual-semantic level (e.g. 'finger' for 'hand'), and all frank visual errors or completely unrelated responses.

The following fourteen dependent variables were derived for each picture.

1. Nameability of the picture (percent of all subjects who were able to produce a codable response with a valid RT)

2. Percent of subjects who failed to produce any name

3. Percent of subjects who produced a response but the RT could not be used (because of false starts, irrelevant noises, etc.)

4. Percent name agreement (percent target names produced out of all codable responses with a valid RT)

5. Number of different names (alternatives) provided on valid trials (including the target name)

6. The H statistic (a measure of response agreement that takes into account the number of alternative names and their frequency)

7. Mean reaction times across all valid trials (i.e. mean latency for all subjects who produced a valid response on that item, regardless of the content of that response)

8. Mean reaction times on target naming (i.e. mean latency only for those subjects who produced the target name for that item)

9. Percent of subjects producing a codable response classified as a morphological variant (Lexical Code 2)

10. Mean RT to produce morphological variants (Lexical Code 2)

11. Percent of subjects producing a codable response classified as a synonym (Lexical Code 3)

12. Mean RT to produce synonyms (Lexical Code 3)

13. Percent of subjects producing a codable response that failed to meet criteria for Lexical Codes 1-3 (Lexical Code 4, including frank visual errors, vague superordinate names like "animal" or "food")

14. Mean RT to produce responses with Lexical Code 4.

In addition to these 14 measures of performance, the target (dominant) names produced for each item have been coded along a number of dimensions that are believed to affect accuracy and/or latency in studies of lexical access. The following variables have been derived, where available, including some that are applicable across languages and others that only apply to a subset of languages (e.g. grammatical gender).

1. Word length, measured in number of characters, and in number of syllables.

2. Presence/absence of a fricative or affricate in the initial consonant (0 = no fricative or affricate; 1 = fricative or affricate), a variable that has been reported to influence the time required for a response to register on the voice key.

3. Complex Word Structure, a dichotomous variable that was assigned to any item on which the dominant response was a plural, a compound word or a periphrastic (multiword) construction.

4. Phonological opacity refers to the relationship between the grammatical gender of the word and its phonological marking (transparent = 0; opaque = 1)

5. Grammatical gender (0 = feminine; 1 = masculine; 2 = neuter).

6. Animacy (0 = animate, for persons or animals; 1 = inanimate, for all other referents including plants, body parts, foodstuffs).

7. Pictures were further grouped into one of 6 lexical categories, to explore possible differences in word retrieval that do not form a scale: objects, food, animals, persons, mobile objects, body parts.

8. Frequencies of the target names were extracted for each language, from written or spoken sources (because there are no frequency corpora available for Bulgarian, subjective ratings of frequency were used).

9. An objective measure of age of acquisition (AoA) was derived from published norms for the American and Italian versions of the MacArthur Communicative Inventory (Caselli & Casadio, 1995; Fenson et al., 1994), a parental report form that provides valid and reliable data about lexical development in Italian infants from 8-30 months. The MacArthur CDI is based on concurrent parent report of vocabulary development in very large samples of children, collected in a recognition-memory format with a large checklist of words that are likely to be acquired between 8-30 months. For our purposes here, the CDI yields a simple 3-point scale: 1 = words acquired (on average) between 8-16 months; 2 = words acquired (on average) between 17-30 months; 3 = words that are not acquired in infancy (> 30 months).

10. For English and Italian, age-of-acquisition ratings for the target words from college students, based on the same 9-point scale that has been used in other studies.

11. For English only, goodness-of-depiction ratings were made by college students, asked to determine (on a 7-point scale, from good to bad) whether the picture was a good representation of the concept to which the target (dominant) name refers.

12. For the Spanish-English data base, we have included several different measures of cognate status, i.e. whether or not (or to what degree) the dominant name in one language overlaps phonologically with the dominant name in the other (more on this below). Although we have coded cognate status only for Spanish and English, it can be computed for any pair of languages in the full set of seven that have participated in the norming study to date.

13. In addition to predictor variables associated with the target names, rough estimates of visual complexity were obtained for the picture itself, based on the format of digitized picture files (see Székely & Bates, in a forthcoming *CRL Newsletter*).

We view this data base as a work in progress, and assume that it will grow over the years as investigators add new analyses and new variables to the set we have developed so far.

Highlights of Results and Future Plans

Although this study is extraordinarily complex, and will probably continue to yield new findings under new analyses for many years to come, a number of manuscripts are currently in preparation, which we will briefly describe.

First, Székely and all the authors of the CRL-IPNP are preparing a manuscript providing further details of the methodology, including comparisons between our results for English and those of Snodgrass and others, for those items in our data set that overlap with theirs (including their published norms for imageability, subjective ratings of Age of Acquisition, various additional frequency norms). The methodological paper indicates that we have replicated virtually all of the results for English published by Snodgrass and colleagues (Snodgrass & Vanderwart, 1980; Snodgrass & Yuditsky, 1996), for those items in our data set that overlap with theirs. Although Snodgrass and Vanderwart were concerned that 260 items would prove too difficult to complete in a single session for normal adult subjects (and for that reason tested their subjects in separate split-half sessions), we found that 520 items could be administered efficiently and accurately in a single session with the timing parameters that we have adopted here. Participants had no difficulty completing the 520 object-naming series; although there was some evidence for fatigue effects (correlations averaging +.35 between RT and event order), order of presentation had no effect on accuracy or name agreement. A brief paper by Székely and Bates documenting another aspect of these results (comparing alternative techniques for the objective measurement of visual complexity) will appear in a forthcoming *CRL Newsletter*.

Second, we are now completing a paper documenting cross-language similarities, differences and intercorrelations for all seven languages in the object-naming study (by the same full set of co-authors listed above). Cross-language comparisons indicate that name agreement is higher and RTs are faster in English (the source community for most pictures), but comparable means and ranges were observed across all languages (averaging 80% target name agreement). There are also a number of findings that reflect cross-language differences in word structure, including length, homophony (same word sound for different pictures) and use of compound and/or periphrastic forms. Other findings include language-by-language replications of previous results for English (e.g. correlations among dependent variables, and effects of length, frequency, age of acquisition), as well as new cross-linguistic results with implications for theories of lexical access. For example, it is usually assumed that frequency effects occur at a lexical level of representation (i.e. the lemma and/or word form level). However, we find that cross-language frequency effects (e.g. correlations between English frequency and Chinese RTs) are just as high as within-language frequency effects (e.g. correlations between Chinese frequency and Chinese RTs), suggesting that frequency effects in picture naming actually reflect aspects of conceptual accessibility or familiarity that are similar across these seven cultures. Within all languages, number of alternative names is associated with slower target RTs even when name agreement is controlled (e.g. for two items with 80% target name agreement, RTs for a picture with five alternative names are slower than RTs for a picture with two alternatives). In contrast with our findings for frequency effects across languages, correlations with number of alternative names do provide evidence for competition within the lexicon.

A parallel manuscript comparing action naming over languages will be prepared when action-naming norms are complete for Italian (due summer 2000), compared with existing norms for English, Spanish and Chinese. This will provide an opportunity to compare object- and action-naming results within each language as well, to determine whether and to what extent the factors that influence noun retrieval differ from the factors that influence retrieval of a verb. Because these languages vary from highly inflected (e.g. Italian, in which a verb can take at least 47 different conjugated forms), to completely uninflected (i.e. Chinese, in which there are no plural markers on nouns, no tense markers on verbs, no inflectional paradigms of any kind), we will also be in a position to assess contributions of word structure and inflectional status to noun vs. verb access in the “citation form.” This will provide useful background for future studies looking at the interaction between lexical retrieval and grammatical context.

A third paper has been submitted (D’Amico, Devescovi, & Bates, 2000), comparing results for our 50 Italian adults with results for 34 Italian-speaking children between 5-6 years of age, on a subset of 260 picture items deemed suitable for children. Although children were substantially slower and less accurate than adults, child and adult performance was highly correlated, and similar correlations were obtained for children and adults between lexical predictors and naming times. However, word complexity had effects on adults that were not seen in children, and grammatical gender had effects on children that were not seen in adults. Adult ratings of age of acquisition had strong effects on both children and adults (and reduced or eliminated effects of frequency in regression analyses), but the objective measure of age of acquisition (based on the Italian version of the MacArthur CDI) only affected children, and did not eliminate frequency effects in regression analyses. Based on z-scores for accuracy and RT (to eliminate the large RT difference for children and adults), significant differences were also observed in the semantic categories that were easiest for children vs. adults (e.g. children found animals and vehicles especially easy to name, evidence for the recency and salience of toys and their associated names for 5-6-year-old children). Comparable child norms for English are being collected by Gowri Iyer at CRL, who also collected the English age-of-acquisition ratings included in our data base (Iyer, 1999).

A fourth brief report (Bates, Burani, D’Amico, & Barca, 2000**)** compares results for object-naming and word reading in Italian, for a subset of 134 items that overlap between our data set and a separate norming study of reading times (Burani, Barca, & Arduino, submitted). We were able to pool independent variables from both studies (including additional ratings for age of acquisition, imageability, concreteness, neighborhood density). To our surprise, the correlation between picture-naming RTs and reading times for the very same words hovered very close to zero (+.03), at least for this set of words, a finding that we are now trying to replicate with the full list of 520 object names. In addition, picture-naming and reading RTs were affected by separate factors (bigger effects of length, density and initial frication for reading time; bigger effects of imageability, concreteness and other semantic variables for picture naming). These disparate findings for reading and picture naming may be due to the highly transparent nature of Italian orthography (with completely predictable grapheme-phoneme correspondence, essentially no orthographic irregulars). We are pursuing this possibility by comparing reading and picture-naming times in English (an irregular orthography) and Chinese (a nonalphabetic, logographic writing system), again for the full set of 520 target object names.

A fifth paper by Kohnert, Wicha, Orozco-Figueroa, Gutierrez and colleagues (in preparation) will summarize results for Spanish-English bilinguals, in both a within- and between-subjects design. These findings will be compared with results for monolingual speakers of the same two languages, including potential differences between cognates (i.e. words that share common form as well as meaning in both languages) and noncognates, controlling for other potential confounds. Because the bilingual data are available for both object and action naming, this will provide another opportunity to compare naming profiles for nouns vs. verbs.

This is just the beginning of our efforts. The CRL-IPNP data base is currently being used to develop stimuli for presentation in functional magnetic resonance imaging (fMRI) studies and event-related brain potential studies of both children and adults, in English, Italian and Chinese (Dick et al., 2000). Other colleagues are using these stimuli in fMRI studies of Spanish-English bilinguals **(**Hernandez et al., in press; Hernandez, Martinez, Wong, Frank, & Buxton, 2000**),** using covert picture naming in single-language presentation (Spanish only or English only) compared with mixed presentation. The potential for interlanguage competition in bilingual picture naming has also been assessed with a subset of these stimuli in life-span studies (from 5-85 years of age -- Kohnert, 2000; Kohnert, Bates, & Hernandez, 1999; Kohnert, Hernandez, & Bates, 1998), including studies focused specifically on the effects of cognitive aging on the bilingual adult's ability to avoid interlanguage interference.

Students and faculty at CRL are currently involved in other bilingual offshoots of this project, including (1) an objective study of cognate status (obtained by testing monolingual subjects in a language they do not know, in a picture-word verification paradigm, establishing the "guessability" of picture names based on cognate status), (2) a new study of age of acquisition in which norms are obtained from bilingual subjects in both their languages, compared side-by-side for each language, and (3) new measures of relative fluency or dominance in which bilinguals are asked to (a) name the pictures in each language (in counterbalanced blocks) under speeded or visually degraded conditions, and (b) judge the match or mismatch between pictures and words using perceptually degraded auditory stimuli.

We are also using this data base to compile a new timed naming test for aphasic patients, to explore dissociations between object naming (reported to be better preserved in nonfluent Broca's aphasics) and action naming (reported to be better presented in fluent Wernicke's aphasics and some anomics -- see Chen & Bates, 1998, for a review). This is a parallel effort, in English, Italian, Spanish and Chinese, part of the continuing project "Cross-linguistic studies of aphasia" (NIDCD R01-DC00216).

Finally, as we hoped when we launched this project three years ago, these naming norms have already proven extremely useful in designing studies to examine sentential and grammatical priming effects on word production (assessed through picture naming in context) and word comprehension (assessed through cued repetition of the same target words, or through picture-word verification). Multiple projects using the picture norms in priming studies are already underway.

By the end of 2000, we plan to put the complete data base (including all the item-specific characteristics that we have been able to derive, for each language) on the CRL website, where these norms can be accessed and used, at no cost, by investigators around the world. We hope to convince our colleagues in other countries to obtain similar norms for their language, and we will cooperate in every way we can to facilitate this process by providing digitized visual stimuli and PsyScope scripts to any interested users.

---

* This is a multifaceted collaborative project that has required great effort by many people. The languages are listed in the order in which they joined the project, which was initially launched for English, Italian and German. At that time, the three investigators with the greatest involvement in design and execution were Bates, Devescovi and Jacobsen. D'Amico and Herron joined and provided substantial input as we developed methods for data analysis and coding. Székely and Pléh were the last to join the project, conducting the object-norming study for Hungarian. At that point, Székely also took over primary responsibility for the design and establishment of a joint data base (with assistance from Bates and D'Amico), and has developed several new variables including the visual complexity metrics described by Székely and Bates (forthcoming). Within each language, the first author listed is the one with primary scientific responsibility for that language and its associated data base; other authors are listed in alphabetical order. The project as a whole was supported by a grant to Elizabeth Bates, "Cross-linguistic studies of aphasia," NIDCD R01 DC00216. Developmental offshoots of the project have been partially supported by NINDS P5022343 and NIDCD P50 DC01289. Each of the associated institutions has provided space for data collection, and personnel time. The Bulgarian portion of the project was also supported by a grant from the James McDonnell Foundation. Our thanks to Meiti Opie and Ayse Saygin for assistance with manuscript preparation, to Robert Buffington and Larry Juarez for technical assistance in development of the norming procedures, and to Luigi Pizzamiglio and Nina Dronkers for assistance in locating picture stimuli.

REFERENCES

Abbate, M.S., & La Chapelle, N.B. (1984a). Pictures, please! An articulation supplement. Communication Skill Builders, Inc.

Abbate, M.S., & La Chapelle, N.B. (1984b). Pictures, please! A language supplement. Communication Skill Builders, Inc.

Appelbaum, M., Bates, E., Pizzamiglio, L., & Salcedo, J. (2000*). Quantifying dissociations in neuropsychological research*. (under review).

Bates, E., Appelbaum, M. & Allard, L. Statistical constraints on the use of single cases in neuropsychological research. *Brain and Language*, 1991a, 40(3), 295-329.

Bates, E., Burani, C., D'Amico, S., & Barca, L. (in preparation). *Differential effects of lexical-semantic and nonlexical variables in naming words and pictures*.

Bates, E., & Devescovi, A. (1989). Crosslinguistic studies of sentence production. In B. MacWhinney & E. Bates (Eds.), *The crosslinguistic study of sentence processing* (pp. 225-253). New York: Cambridge University Press.

Bates, E., Devescovi, A., Hernandez, A., & Pizzamiglio, L. (1996). Gender priming in Italian. *Perception & Psychophysics, 85(7),* 992-1004.

Bates, E., MacDonald, J., MacWhinney, B., & Appelbaum, M. (1991b). A maximum likelihood procedure for the analysis of group and individual data in aphasia research. *Brain and Language, 40*(2), 231-265.

Bates, E., & MacWhinney, B. (1989). Functionalism and the competition model. In B. MacWhinney & E. Bates (Eds.), *The crosslinguistic study of sentence processing* (pp. 3-76). New York: Cambridge University Press.

Bentrovato, S., Devescovi, A., D'Amico, S., & Bates, E. (1999). The effect of grammatical gender and semantic context on lexical access in Italian. *Journal of Psycholinguistic Research, 28*(6), 677-693.

Burani, C., Barca, L. & Arduino, L. (submitted). *Una base di dati sui valori di età di acquisizione, frequenza, familiarità, immaginabilità, concretezza, ed altre variabili lessicali e sublessicali per 626 nomi dell'italiano* [A database on values of age of acquisition, frequency, familiarity, imageability, concreteness, and other lexical and sublexical variables for 626 nouns in Italian].

Caselli, M.C., & Casadio, P. (1995). Il primo vocabulario del bambino: Guida all'uso del questionario MacArthur per la valutazione della comunicazione e del linguaggio nei primi anni di vita [The child's first words: Guide for the use of the MacArthur questionnaire for assessing communication and language in the first years of life] (pp. 94-100). Milan: FrancoAngeli.

Cattell, J. (1886). The time to see and name objects. *Mind, 11*, 63-65.

Chen, S., & Bates, E. (1998). The dissociation between nouns and verbs in Broca's and Wernicke's aphasia: Findings from Chinese. Special issue on Chinese aphasia, *Aphasiology, 12*(1), 5-36.

Cohen, J., MacWhinney, B., Flatt, M., & Provost, J. (1993). PsyScope: An interactive graphic system for designing and controlling experiments in the psychology laboratory using Macintosh computers. *Behavior Research Methods, Instruments, & Computers, 25*, 257-271.

D'Amico, S., Devescovi, A., & Bates, E. (2000). *Picture naming and lexical access in Italian children and adults* (Tech. Rep. CND-0003). La Jolla: University of California, San Diego, Center for Research in Language, Project in Cognitive and Neural Development.

Demuth, K. (1990). Subject, topic and Sesotho passive. *Journal of Child Language, 17*, 67-84.

Dick, F., Bates, E., Martinez, A., Moses, P., Müller, R.-A., Saccuman,C., & Wulfeck, B. (2000). *In-progress pilot studies of fMRI language measures in English and Mandarin Chinese.* Manuscript, Center for Research in Language, University of California, San Diego.

Dunn, Lloyd M., & Dunn, Leota M. (1981). *Peabody Picture Vocabulary Test -- Revised*. Circle Pines, MN: American Guidance Service.

Elman, J., Bates, E., Johnson, M., Karmiloff-Smith, A., Parisi, D., & Plunkett, K. (1996). *Rethinking innateness: A connectionist perspective on development.* Cambridge, MA: MIT Press/ Bradford Books.

Fenson, L., Dale, P.A., Reznick, J.S., Bates, E., Thal, D., & Pethick, S.J. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development, 59* (5, Serial No. 242).

Hernandez, A.E., Martinez, A., & Kohnert, K. (in press). In search of the language switch: An fMRI study of picture naming in Spanish-English bilinguals. *Brain and Language.*

Hernandez, A.E., Martinez, A., Wong, E.C., Frank, L.R., & Buxton, R.B. (2000). *Neuroanatomical correlates of single- and dual-language picture naming in Spanish-English bilinguals.* Dept. of Cognitive Science, Dept. of Psychology, Dept. of Radiology, UCSD.

Hillert, D., & Bates, E. (1996). *Morphological constraints on lexical access: Gender priming in German.* (Tech. Rep. No. 9601). La Jolla: University of California, San Diego, Center for Research in Language.

Iyer, G. (1999). *The role of age of acquisition in picture naming by children and adults.* Manuscript, San Diego State University/University of California, San Diego.

Jacobsen, T. (1999). Effects of grammatical gender on picture and word naming: Evidence from German. *Journal of Psycholinguistic Research, 28*(5), 499-514.

Kaplan, E., Goodglass, H., & Weintraub, S. (1983). *Boston Naming Test*. Philadelphia: Lee & Febiger.

Kohnert, K. (2000*). Lexical skills in bilingual school-age children: Cross-sectional studies in Spanish and English*. Ph.D. dissertation, University of California, San Diego and San Diego State University.

Kohnert, K., Bates, E., & Hernandez, A. (1999). Balancing bilinguals: Lexical-semantic production and cognitive processing in children learning Spanish and English*. Journal of Speech, Language, and Hearing Research, 42*, 1400-1413.

Kohnert, K., Hernandez, A., & Bates, E. (1998). Bilingual performance on the Boston Naming Test: Preliminary norms in Spanish and English. *Brain and Language, 65*, 422-440.

MacWhinney, B. (1987). The competition model. In B. MacWhinney (Ed.), *Mechanisms of language acquisition* (pp. 249-308). Hillsdale, NJ: Erlbaum.

Norman, D., & Shallice, T. (1980). *Attention to action: Willed and automatic control of behavior. Center for Human Information Processing* (Tech. Rep. No. 99). (Reprinted in revised form in R.J. Davidson, G.E. Schwartz, & D. Shapiro [Eds.] [1986], *Consciousness and self-regulation* [Vol. 4]. New York: Plenum Press.

Obler, L.K., & Albert, M. (copyright 1986). *Action naming test*. Boston Veterans Administration Hospital.

Perani, D., Cappa, S., Schnur, T., Tettamanti, M., Collina, S., Rosa, M., & Fazio, F. (1999). The neural correlates of verb and noun processing: A PET study. *Brain, 122,* 2337-2344.

Sanfeliu, M.C., & Fernandez, A. (1996). A set of 254 Snodgrass-Vanderwart pictures standardized for Spanish: Norms for name agreement, image agreement, familiarity, and visual complexity. *Behavior Research Methods, Instruments, & Computers, 28*(4), 537-555.

Schmitt, B.M., Münte, T.F., & Kutas, M. (in press). Electrophysiological estimates of the time course of semantic and phonological encoding during picture naming. *Psychophysiology*.

Shallice, T. (1988). *From neuropsychology to mental structure*. New York: Cambridge University Press.

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

Snodgrass, J.G., & Yuditsky, T. (1996). Naming times for the Snodgrass and Vanderwart pictures. *Behavior Research Methods, Instruments, & Computers*, *28,* 516-536.

Vallar, G. (1999). The methodological foundations of neuropsychology. In F. Denes & L. Pizzamiglio (Eds.), *Handbook of clinical and experimental neuropsychology.* Hove, UK: Psychology Press.

Van Turennout, M., Hagoort, P., & Brown, C. (1997). Electrophysiological evidence on the time course of semantic and phonological processes in speech production. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23*(4), 787-806.

Van Turennout, M., Hagoort, P., & Brown, C. (1998). Brain activity during speaking: From syntax to phonology in 40 milliseconds. *Science, 280*(5363), 572-574.

Van Turennout, M., Hagoort, P., & Brown, C. (1999). The time course of grammatical and phonological processing during speaking: Evidence from event-related brain potentials. *Journal of Psycholinguistic Research, 28*(6), 649-676.

Wicha, N.Y.Y., Bates, E., Orozco-Figueroa, A., Reyes, I., Hernandez, A., & Gavaldón de Barreto (submitted). *When zebras become painted donkeys: Interplay between gender and semantic priming in a Spanish sentence context.*