Studying bilinguals: Methodological and conceptual issues*

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Because the field of bilingualism is still relatively new, studies in the linguistics, psycholinguistics, language development and neurolinguistics of bilingualism have often produced conflicting results. It will be argued in this paper that some of the difficulties encountered by researchers could have been lessened, if not avoided, had close attention been paid to methodological and conceptual issues. Among the issues covered are bilingual participants, language mode, stimuli, tasks as well as models of bilingual representation and processing. Each issue is dealt with in the following way: first it is explained, then the problems it causes are discussed, and, finally, tentative solutions are proposed. Examples are taken from descriptive and experimental studies of normal bilingual adults and children as well as bilinguals suffering from aphasia and dementia.

Most researchers who have studied both monolinguals and bilinguals would undoubtedly agree that working with bilinguals is a more difficult and challenging enterprise. Many reasons come to mind as to why this might be so: bilingualism has been studied less extensively than monolingualism, theoretical models in areas such as bilingual competence, language development and processing are less well developed, conceptual notions and definitions show a great deal of variability, specific methodological considerations have to be taken into account, and so on. One outcome of this situation is that research dealing with bilinguals has often produced conflicting results.

In the field of experimental psycholinguistics, for example, some researchers have proposed that language processing is selective (e.g., Scarborough, Gerard and Cortese, 1984; Gerard and Scarborough, 1989), while others have suggested that it is non-selective (e.g., Altenberg and Cairns, 1983; Beauvillain and Grainger, 1987); some studies have shown evidence for a language-independent lexicon (e.g., Kolers, 1966; Schwanenflugel and Rey, 1986), while others have supported language-dependent lexicons (Tulving and Colotla, 1970; Taylor, 1971); some papers propose that lexical representation is best explained by a word association model or a concept mediation model (both proposed by Potter, So, von Eckhart and Feldman, 1984), while others put forward a revised hierarchical model (Kroll and Stewart, 1994) or a conceptual feature model (de Groot, 1992); some researchers have shown that code-switches in continuous text take time to produce and perceive (e.g., Macnamara, 1967; Macnamara and Kushnir, 1971), while others have shown the opposite (Wakefield, Bradley, Yom and Doughtie, 1975; Chan, Chau and Hoosain, 1983). In the field of bilingual language development, some studies have found evidence that children who acquire two languages simultaneously go through a fusion stage (e.g., Volterra and Taeschner, 1978; Redlinger and Park, 1980), while others have questioned this stage (Meisel, 1989; Paradis and Genesee, 1996), and in the field of neurolinguistics, such questions as hemispheric lateralization and localization of language in bilinguals have been disputed (for a critical review see Zatorre, 1989), as has the inability

* Some of the ideas expressed here were first proposed in a chapter that is part of A. M. B. de Groot & J. F. Kroll (eds.), *Tutorials in bilingualism: Psycholinguistic perspectives*, Cambridge: Cambridge University Press, 1997. Preparation of this paper was made possible in part by two grants from the Swiss National Science Foundation (1213–045375.95 and 3200–049106.96). The author would like to thank the paper's action editor, Judith Kroll, for her very helpful suggestions during the reviewing process. Special thanks go to the following for their comments on various aspects of the paper: Hugo Baetens Beardsmore, Dino Chincotta, Michael Clyne, Anne Cutler, Margaret Deuchar, David Green, Kees de Bot, Ton Dijkstra, James Flege, Karen Heck, Ruth Kearns, Nicolas Léwy, Ping Li, Brian MacWhinney, Lesley Milroy, Carol Myers-Scotton, Shana Poplack, Nanda Poulisse, Tove Skutnabb-Kangas, Jeanine Treffers-Daller and Jyotsna Vaid. Additional thanks go to Marc Grosjean for stimulating discussions on experimental methodology and modeling, as well as Jacqueline Gremaud-Brandhorst, Lysiane Grosjean, Isabelle Racine and Cornelia Tschichold for their careful reading of the manuscript. Requests for reprints can be sent to: François Grosjean, Laboratoire de traitement du langage et de la parole, Université de Neuchâtel, Avenue du Premier-Mars 26, 2000 Neuchâtel, Switzerland.

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https://doi.org/10.1017/S136672899800025X Published online by Cambridge University Press

of some bilingual aphasics to control the production of mixed language in a monolingual environment (e.g., compare Perecman, 1984, with Grosjean, 1985b). This list is not exhaustive and other controversial findings bear on such topics as variability in code-switching patterns in various communities, perceptual boundaries in bilingual listeners, the existence or not of an input or output switch in bilinguals, the lexical routes taken when bilinguals are translating from their weaker language to their stronger language, and so on.

In what follows it will be suggested that some of the difficulties encountered by researchers, and some of the conflicting results they have obtained, could perhaps have been lessened, if not avoided, had close attention been paid to methodological and conceptual issues. Among the issues covered are participants, language mode, stimuli, tasks and models. Concerning participants, I will review the main defining characteristics of the bilingual individual (language history, language proficiency, language use, etc.), list the problems that are encountered in choosing participants, and show that some factors that are not always taken into account in studies clearly affect the results obtained. With regard to language mode, I will describe the language modes bilinguals find themselves in, and show how this affects such issues as code-switching patterns in bilingual speech, the independence or interdependence of language representation, language fusion in very young bilingual children, mixing in aphasics, and so on. As concerns stimuli, I will question the comparability of stimuli within and across studies and will show how some of their characteristics need to be controlled for. As for tasks, I will examine the side-effects that some of them induce, what it is they are tapping into and what aspects of the results are task-specific. I will end with a discussion of the advantages but also the problems of models of bilingual representation and processing, such as the monolingual outlook of some, their use of discrete classifications, the absence of certain components or levels, and the scarcity of global models. (For lack of space, such issues as data collection procedures in naturalistic environments, transcription and categorization of bilingual speech, as well as the problems associated with the statistical analysis of these kinds of data, will not be addressed here.)

Each issue will be dealt with in the following way: first it is explained, then the problems it causes are discussed, and, finally, tentative solutions for future research are proposed. Several points need to be made. First, a lot of what follows has been stated in one way or another over the years by researchers in the field. I will try to do justice to their comments and suggestions but I will probably not be able to refer to everyone concerned for lack of space. If this paper can act as an echo chamber for the field and create further discussion and action around these issues, it will have served its purpose. Second, even though the discussion of each issue will end with suggestions for solutions, it is clear that these are quite tentative and that it is the field as a whole that will solve the problems that have been raised (all researchers have to struggle with these issues and finding solutions is a common challenge). Finally, even though I will mainly consider experimental studies done with adult bilinguals, I will also cover work done with speakers recorded in more natural environments and children, as well as with aphasic and demented patients. Thus, of the five issues that will be discussed, three (participants, language mode and models) concern all researchers working on the bilingual individual, and two (stimuli and tasks) are primarily of interest to experimentalists.

Participants

Issue

Most researchers would probably agree that bilinguals, that is those people who use two (or more) languages (or dialects) in their everyday lives, can be characterized by a number of general features. First, they are usually influenced by what has been called the complementarity principle (Grosjean, in press a), that is, the fact that they usually acquire and use their languages for different purposes, in different domains of life, with different people. Second, and as a direct consequence of this first characteristic, bilinguals are rarely equally fluent in all language skills in all their languages. Level of fluency depends in large part on the need for and use of a language (and a particular skill). Third, some bilinguals may still be in the process of acquiring a language (or language skill), whereas others have attained a certain level of stability. Fourth, the language repertoire of bilinguals may change over time: as the environment changes and the needs for particular language skills also change, so will their competence in these skills. Finally, bilinguals interact both with monolinguals and with other bilinguals and they have to adapt their language behavior accordingly (see the section on language mode).

Even though some research questions may be able to abstract away individual differences that exist among bilinguals (e.g., theoretical questions dealing with aspects of the bilingual's grammars), many others will not be able to do so. Among these differences we find:

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- Language history and language relationship: Which languages (and language skills) were acquired, when and how? Was the cultural context the same or different? What was the pattern of language use? What is the linguistic relationship between the bilingual's languages?
- Language stability: Are one or several languages still being acquired? Is the bilingual in the process of restructuring (maybe even losing) a language or language skill because of a change of linguistic environment? Has a certain language stability been reached?
- Function of languages: Which languages (and language skills) are used currently, in what context, for what purpose and to what extent?
- Language proficiency: What is the bilingual's proficiency in each of the four skills in each language?
- Language modes: How often and for how long is the bilingual in a monolingual mode (i.e. when only one language is active) and in a bilingual mode (i.e. when both languages are active)? When in a bilingual mode, how much code-switching and borrowing is taking place?
- Biographical data: What is the bilingual's age, sex, socio-economic and educational status, etc.?

Of course, many other factors can be added to this list but these are the ones that are most often mentioned in the bilingualism literature.

Problems

Two main problems relate to the participants issue. The first is that some researchers, admittedly only a few, do not yet fully share the field's understanding of who bilinguals really are, and the second is that the factors that have been taken into account when choosing participants are often diverse, insufficient or controversial. As concerns the first problem, some people still feel that bilinguals have or should have equal and perfect fluency in each of their languages (what has been called the two monolinguals in one person viewpoint; Grosjean, 1985a; 1989); others still see language mixing as an anomaly, be it in children acquiring their languages simultaneously or successively, or in adult bilinguals; and others still fail to remember that many bilinguals are also bicultural and that their languages will reflect this dimension. The consequences are that erroneous claims may be made about a particular bilingual behavior, inappropriate comparisons may be made with monolinguals, and exceptional cases may be taken to apply to bilinguals in general. Three examples taken from the literature will illustrate this. First, in a study pertaining to spontaneous translation and language mixing in a polyglot aphasic, Perecman (1984) finds various types of language mixing at all levels of linguistic description in the patient under study. Basing herself on earlier work by Weinreich (1966), who unfortunately did not differentiate between interferences and code-switching, she states that language mixing is inappropriate switching from one language to another and that these "errors" can also be found in normal polyglots. However, language mixing in the form of code-switches and borrowings in bilingual interactions has long been known to be perfectly normal behavior among bilinguals interacting with one another (Poplack, 1980; Grosjean, 1982).

A second example concerns the so-called "semilingualism" of certain bilingual children. Supposedly these children possess less than native-like skills in both languages. They show quantitative deficiencies such as smaller vocabularies when compared with monolingual children, they deviate from monolingual norms, they mix their languages a lot, and so on (see Romaine, 1995, for a survey and a critical review of the question). What proponents of "semilingualism" need to ask themselves before classifying a child in this category are the following three questions: is the child still in the process of becoming bilingual (either learning two languages simultaneously or learning a second language and most probably restructuring the first one)? Is the child mostly in a bilingual, mixed language mode at home and is he or she just discovering the monolingual version of one or of the other language (in the school environment, for example)? Finally, has the child been meeting his or her communicative needs up to then (before entering school, for example)? Answers to these questions will probably show that the "semilingual" child is in the process of adjusting to such things as a new social context, a new language, new language skills and language varieties, new domains of use, etc. One should also remember that the complementarity principle will explain, as it does for the bilingual adult, why the child will never become two monolinguals in one person (Grosjean, in press a).

A third example comes from the field of psycholinguistics. In a study on speech segmentation, Cutler, Mehler, Norris and Segui (1992) used participants who they reported were as bilingual in English and French as they could find: they were accepted as native speakers of French by other speakers of French and accepted as native speakers of English by other speakers of English, they used both languages on an everyday basis, and they had been exposed to both languages simultaneously from one year of age.

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The authors concluded that their participants had, to all intents and purposes, equally perfect command of the two languages. The participants were tested on English and French stimuli but, in the authors' words, the results produced "a puzzling picture," as they were not really comparable to those of either monolingual group. The authors decided therefore to subdivide the participants into subgroups (we will return to how they did this below) since, they report, the overall analysis left them with no obvious point of departure for interpretation of the bilingual results. The point to make here is that bilinguals are speakers-hearers in their own right who will often not give exactly the same kinds of results as monolinguals. One should be ready to accept this and maybe not always seek alternative solutions.

The second problem that relates to participants is that the factors that have been taken into account when choosing participants are often diverse, insufficient or controversial. On the first problem, diversity, one only needs to examine the "participants" section of most papers to realize that they are chosen very differently from one study to the next. Some researchers put the stress on fluency and use various scales or tests to evaluate their bilinguals; others stress language use (which languages are used with whom and for what); still others put the emphasis on language stability (whether their participants are still learning a language or not) and in what context they learned their two (or more) languages, and some few give their participants actual screening tests (reading aloud, counting, understanding a passage, etc.) in addition to presenting biographical data. What is clear is that because the information is so diverse, and the tools of assessment so different, we probably have very different bilinguals in the studies published. Some participants are still acquiring their second language (using language learners is a phenomenon that is on the increase), some are strongly dominant in one language, some others appear to be equally fluent in the spoken but not in the written modality, and some few appear to be quite balanced and active bilinguals. This variability is found between groups and is present within groups also.

At times the information given about participants is simply insufficient to get an idea of who they are. For example, in an often cited study by Caramazza and Brones (1980) that deals with the bilingual lexicon, we are only told that the Spanish-English bilinguals were native speakers of Spanish who ranged in their self-ratings of bilingual fluency from good to excellent (mean rating of 5.5 on a seven point scale). No explanation is given as to what "bilingual fluency" means and none of the factors listed above (language history, language stability, function of languages, etc.) are mentioned. This problem of insufficient information is especially present in studies that deal with aphasic and demented patients. Very little information is given about the patient after the onset of the pathology and even less about him or her prior to it. For example, Perecman (1984) simply gives us the age of the patient (H.B.), where he was born, the order of acquisition of his languages and the fact that English was the language he used primarily from age eighteen on. We know nothing about the patient's proficiency in the four skills in each language prior to his aphasia, the function of his languages, the amount of language mixing he did with other bilinguals, etc. The same problem is also present in child language studies (see, for example, Redlinger and Park, 1980; Vihman, 1985), where little is said about the children's proficiency in each language (admittedly harder to assess), the function of their languages, the amount of time they spent using the languages with monolinguals and bilinguals, and so on (see de Houwer, 1990, for a critical review).

Finally, a few studies take into account controversial factors when choosing or dividing up their participants. One approach that comes to mind is that used by Cutler et al. (1992) to break their participants down into two groups, a French-dominant and an English-dominant group. It should be recalled that these fluent and balanced bilinguals had been chosen because they had equally perfect command of their two languages. The authors tried out several approaches to divide them up and finally found one that produced interpretable data according to them: they asked participants to indicate which language they would choose to keep if they developed a serious disease and their life could only be saved by a brain operation which would have the unfortunate side effect of removing one of their languages. One could discuss at length whether such a question is appropriate (after all, isn't a person bilingual because he or she needs two or more languages in his or her everyday life?) but what should be stressed here is that we have no evidence concerning the validity of such a question for assessing language dominance. As a consequence, we do not really know what kinds of participants fell into each of the two groups. One unfortunate outcome is that replicating the results with similar groups of participants will be very difficult. This is exactly what Kearns (1994) found when she used the same type of highly fluent participants whom she also broke down into subgroups using the same question. Whereas her "French dominant" participants did not show the classic crossover interaction with French stimuli (what has since been called the French syllable effect), Cutler et al.'s

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"French dominant" participants did show it.[1] In addition, and surprisingly, Kearns's "English dominant" participants showed a syllable effect with French stimuli whereas Cutler et al.'s participants did not. In sum, what is at stake here is not dividing up participants into subgroups in order to understand better the results obtained but rather the approach that is used to do so.

The problem of participant selection and description would be less crucial if we did not have evidence that the defining factors listed above (i.e. language history, language stability, function of languages, etc.) are important. In fact, this evidence does exist; concerning the language history and language relationship factor, Segalowitz (1997) shows that there is considerable variability between participants in L2 learning and that this has an impact on language knowledge and language processing; Mayo, Florentine and Buus (1997) present data showing that perception in noise is affected by age of acquisition of the second language; de Groot (1995) suggests that recent use, but also disuse, of a language affects one's lexical representations, etc. As concerns language stability, Kroll and Curley (1988) and Chen and Leung (1989) both show that the processing paths followed during simple word translation is different in language learners and bilinguals who have attained a certain stability and fluency in their languages. As for language function, it is a well known fact that certain domains of life of bilinguals are usually covered exclusively by one language (e.g., work, religion, sports, etc.) and that many bilinguals simply do not have translation equivalents in their other language for these domains, especially if they did not acquire either language in school. Regarding language proficiency, Poplack (1980) shows that one obtains different code-switching patterns depending on how fluent speakers are in their two languages (see also the four switching styles described by Bentahila and Davies (1991) that depend in part on proficiency); Dornic (1978) shows that various linguistic tasks given to bilinguals take more time and are harder to accomplish in their non dominant language; de Groot (1995) reports that the effect found with a bilingual Stroop test depends on the participants' language proficiency; Lanza (1992) demonstrates that the type of mixing young bilingual children do depends on their language dominance; Zatorre (1989) argues that less lateral cerebral asymmetry found in some studies for a bilingual's non dominant language could be due to comprehension problems (and not laterality reasons); Hyltenstam (1991) finds a relationship in demented patients between proficiency in a language and the ability to keep to it separate from the other language, and so on. As for the language mode factor (to which we will return in the next section), Genesee (1989) makes the point that more mixing takes place in children who hear both languages used interchangeably by the same interlocutors. Finally, it is a well known fact that certain biographical variables such as sex and handedness play an important role in language laterality studies (Zatorre, 1989; Vaid and Hall, 1991).

[1] According to Frauenfelder and Kearns (1997), a syllable effect is generally characterized as a significant interaction of target type and word type. Participants are faster or more accurate in detecting targets which correspond exactly to the first syllable of a word than targets which correspond to more or less than the first syllable. The authors add that according to a more stringent criterion, to be able to infer a syllable effect there must be a significant crossover interaction between target type and word type.

Tentative solutions

Concerning the first problem, the lack of understanding of who bilinguals really are, all that can be said is that there are a sufficient number of general introductions to the field to help researchers not to fall into this trap (see, for example, Grosjean, 1982; Beatens-Beardsmore, 1986; Appel and Muysken, 1987; Edwards, 1995; Romaine, 1995). As for the second problem, factors that have to be taken into account in choosing participants, one can always make bilingual assessment measures covariate variables during the analysis of results or allow participants to be their own control when the study permits it (which is not often the case). But the main solution will no doubt be for the field to agree on the kind of information that should be reported to describe the main types of bilinguals used (adult bilinguals, second language learners, bilingual children, polyglot aphasics or demented patients, etc.). For example, papers in experimental psycholinguistics could be expected (if not required) to have an appendix containing the following information on the group(s) used: biographical data (mean age, number of males and females, educational level of participants); language history (age participants started acquiring each skill in each language; manner of acquiring the languages, etc.); language stability (skills in the languages still being actively acquired); function of languages (which languages are used and in what contexts); proficiency (proficiency ratings in the four skills in the participants' languages); language mode (amount of time spent in the monolingual and in the bilingual mode). Each of these factors may have an impact on processing and representation and should therefore be assessed. Of course, much of the information can be collected via questionnaires by means

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of scales and can be reported numerically (central tendencies and dispersions). Other domains may choose to add or take out factors and one could even think of adding actual performance measures. Two points need to be made. First, it is important that if self rating scales are used, differences in the way people rate themselves be controlled for. It appears to be the case that due to various factors, some individuals, and even some groups, have no problem using endpoints of scales, and sometimes over-rate themselves, while others are more conservative in their self evaluation. Anchoring scales properly will therefore be very important for comparison across groups. For example, one could use as a yardstick native speakers of a language. Second, it appears crucial to distinguish between language learners in an academic setting who do not usually interact socially with their two languages and who therefore are not really bilingual (at least yet), and people who are acquiring a language in a natural environment and who are using both languages on a regular basis. The former should be characterized as "language learners", and maybe not as "novice" or "non fluent" bilinguals, at least until they start using both languages on a regular basis.

Language mode

Issue

In their everyday lives bilinguals find themselves in various language modes that correspond to points on a monolingual-bilingual mode continuum (Grosjean, 1985a, 1994, 1997). A mode is a state of activation of the bilingual's languages and language processing mechanisms. This state is controlled by such variables as who the bilingual is speaking or listening to, the situation, the topic, the purpose of the interaction, and so on. At one end of the continuum, bilinguals are in a totally monolingual language mode in that they are interacting only with (or listening only to) monolinguals of one – or the other – of the languages they know. One language is active and the other is deactivated. At the other end of the continuum, bilinguals find themselves in a bilingual language mode in that they are communicating with (or listening to) bilinguals who share their two (or more) languages and where language mixing may take place (i.e., code-switching and borrowing). In this case, both languages are active but the one that is used as the main language of processing (the base or matrix language) is more active than the other. These are end points, and bilinguals also find themselves at intermediary points depending on the factors mentioned above.

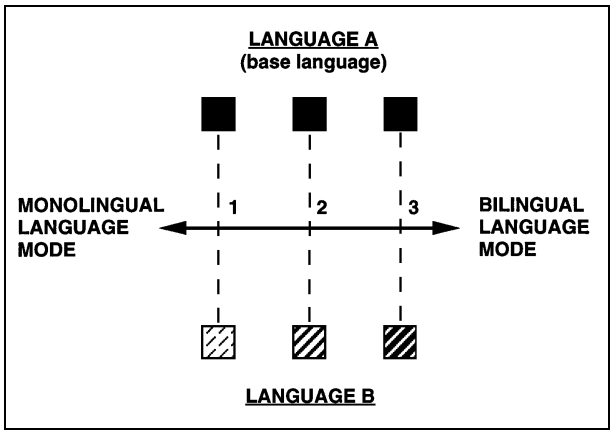


Figure 1. Visual representation of the language mode continuum. The bilingual's positions on the continuum are represented by the broken vertical lines and the level of language activation by the degree of darkness of the squares (black is active and white is inactive).

Figure 1 is a visual representation of the continuum. The languages (A and B) are represented by a square located in the top and bottom parts of the figure and their level of activation is depicted by the degree of darkness of the square: black for a highly active language and white for a deactivated language. Although the figure can be used to illustrate the level of activation of the two languages during both production and perception, I will concentrate on production first and then deal with perception.

Three hypothetical positions for the same bilingual are presented in the figure (broken lines numbered from 1 to 3). In all positions, the bilingual speaker is using language A as the main language of communication (the base language) and it is therefore the most active (black square). In position 1, the speaker is in a monolingual mode: language A is totally active whereas language B is deactivated (Green (1986) would even say that it is inhibited). This mode arises when the person being spoken to is monolingual (in this case, in language A), and/or the topic, the situation or the purpose of interaction require that only one language be spoken to the exclusion of the other(s). It is in this mode that interferences, that is, speaker-specific deviations from the language being spoken due to the influence of the other deactivated language, are the most visible (they can also occur in the bilingual mode but they are difficult to separate from other forms of language mixing such as code-switches and borrowings). In position 2, the speaker is in an intermediary mode. Language A is still the most active language (it is the language of communication) but language B is also partly activated. This kind of mode arises, for example, when a bilingual is

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speaking to another bilingual who does not wish to use the other language (in this case, language B) or when a bilingual is interacting with a person who has limited knowledge of the other language. Any number of combinations of interlocutor, topic, situation and purpose of interaction can lead to this intermediary position. In position 3, the speaker is at the bilingual end of the continuum. Both languages are active but language B is slightly less active than language A as it is not currently the language of communication. This is the kind of mode bilinguals find themselves in when they are interacting with other bilinguals who share their two (or more) languages and with whom they feel comfortable mixing languages. They usually first adopt a base language to use together (language A here, hence its greater level of activation) but the other language, often referred to as the guest language, is available in case it is needed in the form of code-switches and borrowings. A code-switch is a complete shift to the other language for a word, a phrase or a sentence, whereas a borrowing is a word or short expression taken from the less activated language and adapted morphosyntactically (and sometimes phonologically) into the base language. Borrowings can involve both the form and the content of a word (these are called nonce borrowings) or simply the content (called loan shifts). Of course, a change of topic or of situation may lead to a change of base language. In our example, language B would then become the most active (it would be represented by a black square) and language A would be slightly less active (the black square would contain white diagonal lines). It should be noted that bilinguals differ among themselves as to the extent they travel along the continuum; some rarely find themselves at the bilingual end whereas others rarely leave this end (for example, bilinguals who live in communities where mixed language is the norm).

Because Figure 1 presents two variables (the base language on the vertical axis and the language mode on the horizontal axis), it is important that both are mentioned when describing the situation a bilingual is in. Thus, for example, a French-English bilingual speaking French to a French monolingual is in a ''French monolingual mode.'' The same bilingual speaking English to an English monolingual is in an ''English monolingual mode.'' If this person meets another French-English bilingual and they choose to speak French together and code-switch into English from time to time, then both are in a ''French bilingual mode''. Of course, if for some reason the base language were to change (because of a change of topic, for example), then they would be in an ''English bilingual mode'', etc. It should be remembered that the base language variable is usually independent of the language mode variable. Hence, saying that a bilingual is in a English language mode leaves totally open whether the mode is monolingual or bilingual.

Everything that has been said about speakers also pertains to listeners or readers. For example, and whatever the base language, if listeners determine (consciously or not), or find out as they go along, that what they are listening to can contain elements from the other language, they will put themselves partly in a bilingual mode, that is, activate both their languages (with the base language being more strongly activated). This is also true of readers, whether they are reading a continuous text or looking at individual lexical items interspersed with items from the other language. Simply knowing that there is a possibility that elements from the other language will be presented (in an experiment, for example) will move the bilingual away from the monolingual endpoint of the continuum. Just one guest word in a stream of base language words can increase this displacement towards the bilingual endpoint.

Evidence for the language mode continuum concept is starting to be quite extensive. For example, in a production study, Grosjean (1997) manipulated the language mode participants were in when retelling stories that contained code-switches. He found that the three dependent measures (number of base language syllables, number of guest language syllables and number of disfluencies produced) were all affected by the language mode the speakers were in. In a developmental study, Lanza (1992) found that the same child mixed languages much more when in a bilingual context (represented by her father) than in a monolingual context (represented by her mother). As for evidence from an adult naturalistic setting, it can be found in a study by Treffers-Daller (1997) that is described below.

Problems

Because the mode a bilingual is in corresponds to a state of activation of the bilingual's languages and language processing mechanisms, it has an impact both on language production (maintenance or change of the base language, amount and type of language mixing that takes place, etc.) as well as on language perception (speed of processing of a language, access to one or to both lexicons, role of the less activated language, etc.). It appears critical therefore that one control for the mode participants are in when they are being recorded or tested experimentally. This has not been the case very often, as can be

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seen by examining examples from a number of different domains. In a first domain, research on interferences (also known by some as transfers; for a review see Odlin, 1989), the mode bilingual participants are in when interferences are observed has rarely been reported. Thus, what might appear on the surface as an interference could also be a code-switch or a borrowing produced by the speaker who is aware that his or her interlocutor knows the other language (to some extent at least). For example, although "baving" (from the French verb "baver" (to dribble)), produced in an English monolingual mode, is probably the result of the deactivated language "intruding" onto the language being spoken (an interference, therefore), in a bilingual mode it is either an interference or, more probably, the normal access of a word in the less activated lexicon and its integration into the base language (a borrowing). It is now widely recognized that in Weinreich's (1966) classical work on bilingualism, the concept of interference covered the whole range of possible bilingual productions (true interferences in both the monolingual and the bilingual mode as well as code-switches and borrowings in the bilingual mode). This is also clearly the case with the interferences discussed by Taeschner (1983) in her study of two bilingual children. In sum, to have any chance of identifying interferences correctly one needs to be sure that the data collected come from a truly monolingual mode. (See Grosjean, in press b, for further discussion of this.)

A second domain of study where it is important to know where bilinguals are positioned on the language mode continuum concerns natural interview situations. This information is not often given in the description of the interview setting and yet Treffers-Daller (1997), among others, has shown that depending on the speaker's position on the continuum (based on the interlocutor, the topic, the situation, etc.), different types of language behavior will be obtained. In her study, she placed the same speaker, a Turkish-German bilingual, in three different positions by changing the context and the interlocutors, and she found quite different code-switching patterns. For example, when the participant was speaking to another bilingual he did not know well, his code-switches were less numerous, more peripheral and contained various types of pauses (the latter have been called flagged switches). However, when the participant interacted with a very close bilingual friend, the code-switches were more numerous, they were both intra- and intersentential and they were produced without hesitations or special highlighting (these have been termed fluent switches). Based on these results (also observed by Poplack (1981) in a different context), Treffers-Daller concludes that the language mode continuum concept may offer a new approach to study variable code-switching patterns within and between communities (e.g., Poplack, 1985; Bentahila and Davies, 1991) because it can help predict the frequency and type of switching that takes place.

A third domain where the language mode needs to be controlled for is experimental psycholinguistics. Several domains of research are concerned, but I will concentrate here on the language representation issue. This pertains to whether bilinguals have an integrated semantic memory for their two languages (also called a shared or a common store) or whether they have two separate, independent semantic systems. Several studies have addressed this question. For example, Schwanenflugel and Rey (1986) used a cross-language priming task in which Spanish-English bilinguals saw the prime word "body" and immediately afterwards had to say whether the following item, either "brazo" (arm) or "arm", was a word or not. The authors found that whether the prime and the following word (the target) were in the same or in different languages had no effect on the amount of priming, and they concluded that concepts in the bilingual individual are represented by a language neutral conceptual system. In a more recent study, Fox (1996) used flanker words to prime targets and found an equal level of negative priming for monolingual and bilingual word pairs. She also concluded that mental representations of words in a bilingual's two languages are integrated within a shared representational system. Although both studies were carefully conducted and produced reliable data, it is difficult to tease apart in the results obtained what is due to the representational issue and what is caused by the language mode variable. The bilinguals were probably not in a monolingual mode when they were tested. Participants knew they were being tested as bilinguals and they saw words in the two languages. Because of this, they had probably activated both their languages (consciously or unconsciously) and were thus in a bilingual mode. (The same argument can be made about masked priming studies if considerable care is not taken to put participants in a monolingual mode.) If both languages are active, bilinguals are then in a position to react as quickly to targets in the language of the prime (or flanker word) as to targets in the other language (all other things being equal). No claim is being made here concerning the substantive issue of shared as opposed to separate semantic stores or, more concretely, which language(s) is / are primed in within- and between-language experimental studies. The only point being put forward is that the language

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mode variable can certainly influence, and maybe sometimes even account for, the results obtained. (The same is probably true of studies examining selective versus non-selective processing in bilinguals, as will be seen later).

Another domain of research which has not always controlled for language mode sufficiently concerns simultaneous language acquisition in bilingual children. It has been proposed by some researchers (Volterra and Taeschner, 1978; Redlinger and Park, 1980, among others) that children who acquire two languages simultaneously go through an early fusion stage in which the languages are in fact one system (one lexicon, one grammar, etc.). They then slowly differentiate their languages, first separating their lexicons and then their grammar. Evidence for this has come from the observation of language mixing in very young bilingual children and from the fact that there is a gradual reduction of mixing as the child grows older. This position has been criticized by a number of researchers (e.g., Meisel, 1989; Genesee, 1989, among others) and one of the points made each time (in addition to the fact that translation equivalents may not be known in the other language) is that the children were often in a bilingual mode, i.e. the caretakers were usually bilingual themselves and were probably overheard using both languages, separately or in a mixed form, by the children, if not actually mixing their languages with them (see Goodz, 1989). In addition, the context in which the recordings were made for the studies probably induced language mixing. If one examines the procedure followed by Redlinger and Park (1980) and Vihman (1985), for example, it is clear that the recording context was rarely (if ever) monolingual. In the first study, the investigator spoke the same languages as two of the bilingual children and, in addition, the children's parents appear to have been present, and in the second study, the person doing the taping was the mother of the child (Raivo) and she was herself bilingual. In both cases, therefore, the children were in a bilingual context which induced a bilingual mode and hence language mixing. It is interesting to note that Lanza (1992) shows clear differences in mixing behavior for the same child when interacting with two different adults, one of whom prefers a monolingual interaction and one who accepts language mixing. (See Genesee, Boivin and Nicoladis, 1996, for a similar type of study where the adult interlocutors were two monolinguals, one in each language, and one bilingual.)

A final domain in which language mode is a crucial variable is language pathology. For example, in the domain of bilingual aphasia, several case studies have been published of patients who appear to mix languages inappropriately. Perecman (1984), for instance, states that the language of her patient (H.B.) was strongly marked by language mixing. The author writes that H.B. shifted from one language to another during the course of a single conversation and within the same utterance. However, we learn in the same paper that language mixing was particularly pronounced when the investigator (or investigators, it is unclear if there were one or two) shifted from one language to another within the same conversation or task, and we are actually given an extract from a dialogue in which the investigator switches languages! As was stated in a response to Perecman's paper (Grosjean, 1985b), it is interesting to speculate how much language switching H.B. would have produced had the investigator been totally monolingual. It seems only appropriate that a bilingual aphasic who is in a bilingual context, and who is faced with production problems, should use language mixing as a strategy to enhance communication (as would normal bilinguals). Another example comes from language production in bilinguals who suffer from dementia. Hyltenstam (1991), for instance, presents formally elicited data gathered from Finnish-Swedish patients recorded in what he states is a monolingual interaction, with a native speaker of each language, as well as in a bilingual interaction. The Swedish interactant was indeed monolingual but the Finnish one was also a speaker of Swedish, as we learn later in the paper. It is not surprising therefore to find in the Finnish productions language patterns ranging from monolingual Finnish utterances to mixed Finnish-Swedish utterances. It should be noted that mixing also took place in the Swedish monolingual interactions, but these can clearly be attributed to the patients' dementia. One cannot say the same thing concerning mixing in the Finnish interactions.

To conclude, failure to control for the bilingual mode factor produces at best very variable data due to the fact that participants are probably situated at various points along the monolingual-bilingual continuum, and at worst ambiguous data given the confound between this factor and the variable under study.

Tentative solutions

Language mode is a variable to be studied independently (one will need to investigate ways of determining the bilingual's position on the continuum, among other things) but it is also a variable to control for. In what follows I will concentrate on this latter aspect as failure to control for language mode has important implications for the way in which

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findings are interpreted. Because of lack of space, I will only consider how bilinguals can be put either in a strict monolingual mode or in a totally bilingual mode. As concerns the monolingual mode, two inappropriate approaches have been tried. The first is to put the participants in a "language set" (also called erroneously by some a "language mode") by giving them instructions in one language, getting them to do preliminary tasks in that language, occasionally presenting reminders in that language, giving them monolingual stimuli, etc. What this does is to activate a particular base language (the variable depicted on the vertical axis in Figure 1) but, as indicated earlier, it in no way guarantees a particular position on the monolingual-bilingual mode continuum (the variable on the horizontal axis).[2] The second approach, which has been used a lot with bilingual children, second language learners and aphasic or demented patients, has been to hide the experimenter's or interviewer's bilingualism. This is a very dangerous strategy as subtle cues such as facial expression and body language can give away the interlocutor's comprehension of the other language. In addition, it will not prevent occasional slip-ups such as responding in the "wrong" language or showing in one's response that what has been said in that language has been understood.

The solution to the monolingual mode problem is unfortunately not quite as easy as one would like it to be. For interview situations, if the researcher is interested in observing how a bilingual can produce just one language (something a bilingual often has to do), then the interviewer must be completely monolingual in that language (and not feign to be). In addition, the situation must be monolingual and there must not be any other person present who knows the other language. For more experimental situations, the difficulty is how to prevent the bilingual from activating, to some extent at least, the other language. If interest is shown in the participant's bilingualism, if he or she is tested in a laboratory that works on bilingualism, if the experimenter is bilingual or if the participant sees or hears stimuli from both languages, then any one of these factors is sufficient to put the participant in a bilingual mode and hence activate the two languages, albeit to differing degrees. Such questions as the independence or interdependence of the bilingual's language systems or the "automatic" influence of one language on the other (selective versus non-selective processing) cannot be studied adequately if this is so, even if precautions such as masking primes are taken (e.g., Bijeljac-Babic, Biardeau & Grainger, 1997). One possibility that comes to mind appears to be to intermix bilingual participants in with monolingual participants in a monolingual experiment (for example, a study that is part of a course requirement) and once the experiment is done, and after the fact only, so as to avoid the Rosenthal effect, to go back into the list of participants and extract the bilinguals. In addition, care will have to be taken that the stimuli presented do not give the aim away. Of course, one can also make the bilingual mode an independent variable and use two or more intermediary levels of the continuum (e.g., Grosjean, 1997) but there is no guarantee that the most monolingual level will be monolingual enough to make claims about non-selective processing or interdependent representations.

As concerns the bilingual endpoint of the language mode continuum, care will have to be taken that the participants are totally comfortable producing, or listening to, mixed language. This can be done by having bilingual experimenters or interviewers who belong to the same bilingual community as the participants and, if possible, who know them well. They should interact with the participants in mixed language and the situation should be conducive to mixed language (no monolinguals present, a relaxed non-normative atmosphere, etc.).

Stimuli

Issue

Stimuli used in bilingual studies, such as syllables, words, phrases, and sentences, differ in a number of ways within and between languages. For example, words can differ on graphic form, frequency of graphic form, frequency and density of graphic form neighbors, phonetic form, frequency of phonetic form, frequency and density of phonetic form neighbors, syntactic categories and frequency of these categories, meanings of the various syntactic forms, concreteness-abstractness, animacy, etc. For instance, if one takes French "pays" (country) and English "pays", two homographs taken from a study conducted by Beauvillain and Grainger (1987), one notices that although both graphic forms are quite

[2] Interestingly, and with hindsight, the participants who were tested in Soares and Grosjean's (1984) study, "Bilinguals in a monolingual and a bilingual speech mode: The effect on lexical access," were never in a totally monolingual mode. This is because they knew the study dealt with bilingualism and they were accustomed to code-switch with one of the experimenters. Instructions in each of the two languages and practice sentences in these languages did help to establish the base language (or language set) in the "monolingual" parts of the study. This, added to the fact that the stimuli were in only one language, probably pushed the participants towards the monolingual endpoint of the continuum. Whether they actually reached that monolingual endpoint is doubtful, however.

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frequent, English "pays" probably has more graphic form neighbors than French "pays". As for the phonetic form, the two are quite different, as English /peɪz/ contains a diphthong and a terminal consonant, whereas French /pei/ has two vowels and no final consonant. The phonetic form frequency is probably quite similar in the two languages but the English form has more neighbors than the French form. As concerns syntactic categories, English "pays" is an inflected verb and a very rarely found noun in its plural form. As for French "pays", it is only a noun and it is far more frequent than the English noun. Moving on to meaning, the English verb form of "pays" has four meanings and the noun form has two meanings. The French noun "pays" has three meanings and they are all different from the English noun meanings. Finally, there is a certain diversity as to concreteness and animacy of the various French and English meanings. Thus, as can be seen from this apparently simple case, stimuli will differ considerably from one another.

Problems

Three problems surround stimuli in bilingual studies: differences in the stimuli used across studies, differences in stimuli used within studies, and factors that need to be controlled for in stimulus selection. As concerns differences in stimuli used across studies, what are often thought to be similar stimuli are unfortunately not always that similar. For example, much work has been done with cognates, defined by Crystal (1991) as linguistic forms that are historically derived from the same source as other language forms. When one compares how different researchers define the concept, one finds very large differences. For example, concerning the graphemic form of cognates, de Groot (1995) says it is similar, Caramazza and Brones (1979) say it is identical, Sánchez-Casas, Davis and García-Albea (1992) talk of a large degree of overlap, and Beauvillain and Grainger (1987) say it is the same. As concerns meaning, the labels used respectively are: similar, same, large degree of overlap, similar. Finally, with respect to phonology, De Groot says it is similar, Caramazza and Brones state that it is different (!), and the two other studies do not give any information on this factor. Because of the problem of understanding what is meant by "similar," "same" and "large degree of overlap," and based on the fact that words often have several meanings with different frequencies, among other things, it is no surprise that differences are found across studies (especially if the tasks used call on all the linguistic aspects of cognates, including phonology). In fact, Votaw (1992) shows the complexity of the issue in a six-cell table in which she presents three levels of shared form and three levels of shared meaning. Even though she does not refer to phonological form and to multi-meaning cognates, the table is useful for observing which cells are covered by the different studies that have used cognates. What has just been said about cognates also pertains to other "similar" stimuli across studies.

Concerning differences in stimuli within studies, the issue is one of variability. An example comes from the homographs used by Beauvillain and Grainger (1987). We have already seen that English "pays" and French "pays" share the noun category (although the English word is very much more frequent as a verb) and that as nouns the meanings are different in the two languages. When we compare this pair with another pair that was used in the same study, English "lame" and French "lame" (blade), we find another pattern of differences. English "lame" is an adjective and a verb (also a very rare noun) whereas French "lame" is only a noun. The cause of this variability is quite understandable (there are only a small set of homographs to choose from in the two languages), but if variability within a study is too large, it can reduce the effect that is sought or actually make it disappear.

As for factors that need to be controlled for during stimulus preparation, several have been mentioned in recent years, making studies which do not control for them somewhat problematic. For example, concreteness is an important variable both in neurolinguistics and psycholinguistics. In the former domain, Zatorre (1989) reports that concrete nouns are processed more bilaterally than abstract nouns. In psycholinguistics, de Groot (1992) has shown that concrete words are translated faster than abstract words. She also states that cognates and infrequent words are more likely to be translated by means of the word-word association route. Sholl (1995) has shown that animacy has clear effects on word translation: animate concepts are translated more rapidly than inanimate concepts. As for Grainger and Beauvillain (1987), they put forward the orthographical uniqueness of a word as a factor. In a lexical decision task, they showed a cost for language mixing in word lists; mixed lists produced longer reaction times than pure lists. The cost disappeared, however, when the words in each language were orthographically unique to that language. Finally, in research on spoken word recognition of code-switches and borrowings, a number of factors have been found to play a role: phonotactics and language phonetics (Grosjean, 1988; Li, 1996), interlanguage neighbor proximity (Grosjean, 1988) and sentential context (Li, 1996). Not controlling for such

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factors (at least the more important ones) can lead to weak effects or no effects, to different or contradictory results across studies, and to the difficulty of replicating published studies.

Tentative solutions

At least four well-established solutions known to most researchers in psycholinguistics can be used to solve or lessen the stimuli problem. The first but also the hardest is to control for as many linguistic factors as possible when choosing stimuli. The second is to replicate the results using a new set of stimuli, and the third is to use stimuli as their own control when possible (although one must avoid repetition effects across conditions). Finally, the fourth, and probably the most appropriate for cross-study comparisons, is simply to reuse the stimuli that have appeared in an already published study so as to replicate the results or to show that some specific independent variable can modify the outcome of the experiment.

A long-term solution to the problem would be for the field to start putting together normalized stimuli for pairs of languages, such as lists of cognates and homographs controlled on a number of variables, word frequency counts and word association lists obtained from bilingual groups, etc. This kind of information already exists in monolingual research and it provides many advantages, not the least being that the experimenter can spend more time on other aspects of the study.

Tasks

Issue

Experimental tasks used to study bilinguals range from those used in production studies (reading lists or continuous text aloud, retelling stories, naming pictures under various conditions, giving word associations, etc.), to those in perception and comprehension studies (free recall, syllable identification and discrimination, Stroop tests, eye tracking, word priming, lexical decision, translation, etc.), all the way to those in hemispheric lateralization studies (dichotic listening, hemifield presentation, concurrent activity tasks, etc.).

Problems

Some problems are common to monolingual and bilingual research such as those that relate to strategic versus automatic processes involved in the task, the metalinguistic nature of the task, its processing locus, the allocation of attention during the task, etc. There is also much debate around such questions as the size of the SOA (stimulus onset asynchrony), the blocking or not of stimuli, the proportion of filler items, etc. I will concentrate however on three specific problems. The first concerns how certain tasks activate both the bilingual's languages and hence create a confound between the bilingual mode the participant is in and the variable under study. The second deals with the question of what certain tasks are tapping into, and the third concerns which aspects of the results depend on the task itself and which on the variable being studied.

As concerns the first problem, it is clear that such tasks as the bilingual Stroop test, bilingual word priming, bilingual association production, bilingual category matching, word translation, and so on, all activate both languages in the bilingual. In the bilingual Stroop test, one cannot perceive the word "red" written in green and respond "vert" (green in French) without having both languages activated. In the bilingual category matching task, one cannot see the name of a category in one language (e.g., "furniture") and then an instance of that category in another language (e.g., "silla" (chair in Spanish)), without activating both languages. This becomes a very real problem when the question being studied pertains to such issues as selective versus non-selective processing, the independence or the interdependence of the bilingual's language systems, or one versus two lexicons. If one is interested in these issues, one should be careful not to activate the other language by using a task that does just that. When this occurs, it becomes difficult to disentangle what is due to normal bilingual representation and processing, and what is due to the bilingual language mode induced by the task.

For example, Beauvillain and Grainger (1987) wanted to find evidence for the presence or absence of language-selective access of interlexical homographs during visual word perception. To do this, in the first experiment they presented pairs of words in two conditions. In the related condition, the first word (the context word) was a homograph in English and French (e.g., "coin" which means corner in French) and it was followed by a test word (e.g., "money") that could be primed by its English meaning but not its French meaning. In the unrelated condition, the context word was only an English word (not a homograph) and the test word had no relationship to it. The participants were told that the first word would always be a French word and they were never informed of the presence of homographs (the pairs were mixed in with filler pairs). They were asked to do a lexical decision on the second item and were informed that it would be an English word or

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non word. The authors hypothesized that selective access would be confirmed if the context word in the related condition (''coin'') were found not to facilitate the test word (''money''); if there was facilitation, however, then non-selective access would be shown. The results showed that facilitation was in fact obtained, that is, that reaction times were faster in the related than in the unrelated condition. This was replicated in a second experiment and the authors concluded that lexical access in bilinguals is not initially language-selective. The problem, of course, is that despite the instructions which were meant to force participants to ignore the meaning of the homograph in the other language, the bilinguals needed their two languages to do the task, i.e. read the context word in French and then decide whether the second word was an English word or not. To do this, they had to put themselves in a bilingual language mode and activate both their lexicons. (It should be noted that as they were tested as bilinguals, they were probably already in a bilingual mode before the experiment even started.) It is no surprise therefore that a result indicating non-selective processing was obtained (the same comment can be made about another well known study which examined the same question, that of Altenberg and Cairns, 1983). Recently, Dijkstra, van Jaarsveld and ten Brinke (1998) have shown that interlingual homographs may be recognized faster than, slower than, or as fast as monolingual control words depending on task requirements and language intermixing. Even though they did not account for their findings in terms of language mode, it is clear that both these variables affect the mode and hence the results obtained. What one can conclude from this is that, whenever possible, tasks or conditions that activate both languages should not be used to study issues such as selective versus non-selective processing, or the independence versus the interdependence of the bilingual's language systems.

The second problem that concerns tasks is that it is difficult to know what tasks are tapping into: language processing, language representation or both? It is interesting to note that most monolingual studies that use priming tasks, lexical decision, or the Stroop test are basically aimed at understanding processing, i.e., how words are accessed in the lexicon. The findings that have come out of this research have mainly been used to build processing models and not representational models. However, probably because of an early interest in bilingual language representation, these same tasks are often used to study representation in bilinguals. Unless one espouses a view that equates processing with representation (something that becomes very difficult to defend at higher language levels), one should try to come to grips with this second, highly delicate, problem. Unfortunately, the field is hesitant about the issue and we find researchers using identical tasks to tap into representation and processing. For example, Beauvillain and Grainger (1987) used priming with lexical decision to get at the selective access issue, whereas Schwanenflugel and Rey (1986) used this same task (with minor procedural differences) to get at the representational issue. If a task is indeed reflecting representation, then we need to know which level of representation it is reflecting. For example, in lexical representation research, we have to know which of the following four levels is being tapped into: the lexeme level, the lemma level, the conceptual level or the encyclopedic level (which is outside the lexicon).

The third problem concerns which aspects of the results depend on the specific processing demands of the task itself and which on the variable being studied. Many conflicting results in the literature, in particular those concerning the one versus two lexicons issue, can be accounted for by this problem. It will be recalled that in the 60s and 70s an extensive debate took place around whether bilinguals have one language-independent store or whether they have two language-dependent stores. Much evidence was collected for each hypothesis, but little by little researchers started realizing that there was a confound between the tasks used to study the question and the question itself. Kolers and Gonzalez (1980) were among the first to state that two different issues had become confused in the study of bilingual memory, the issue of representation, its commonness across languages or its means dependency, and the way the issue is tested. They suggested that the bilingual's linguistic representations are independent or dependent to the degree that particular skills are utilized in a given context or task. Scarborough, Gerard and Cortese (1984) stated practically the same thing when they wrote that a bilingual might appear to have a separate or an integrated memory system depending upon how task demands control encoding or retrieval strategies (see also Durgunoglu and Roediger, 1987). Since then the focus has shifted away from the one versus two lexicons question to how the bilingual's lexical representation might be organized (see for example Potter et al., 1984; Kroll and Stewart, 1994; de Groot, 1992), but the problem of what the task is doing has not disappeared completely, as can be seen in discussions by Fox (1996) and Kroll and de Groot (1997), among others. The task effect is also present in neurolinguistics where it has been shown that orthographic comparisons yield consistent left visual field advantages while phonolo-

https://doi.org/10.1017/S136672899800025X Published online by Cambridge University Press

gical and syntactic judgments give right visual field advantages (Vaid, 1983; Vaid, 1987; Zatorre, 1989).

Tentative solutions

The first problem mentioned, the fact that certain tasks activate both the bilingual's languages, is very difficult to solve if one is interested in issues such as selective processing or the independent nature of language representation in bilinguals. If that is the case, one must make sure that the task is not artefactually activating the bilingual's two languages and/or processing systems. The task must be monolingual in nature and must not involve processes such as cross language priming, perception in one language and production in the other, etc. If the question of interest is different, such as whether distinct groups of bilinguals behave differently when perceiving or producing language, then the dual language activation nature of the task should simply be controlled for.

The other two problems (what it is that tasks are reflecting and which aspects of the results are task specific) can be addressed by having a very good understanding of the tasks used in bilingualism research: what issues can be studied with them, which variables can be tested, what the dependent measures are, the advantages and problems of the tasks, and so on. It would be important one day to develop a guide to bilingual research paradigms along the lines of the one proposed by Grosjean and Frauenfelder (1997) for spoken word recognition paradigms. Finally, several paradigms can be used to obtain converging evidence, but one must keep in mind that similar effects, revealed by similar values of a dependent measure, may not always reflect similar processing routes and similar underlying representations.

Models

Issue

One of the main aims of research on bilingualism, whether descriptive, theoretical or experimental, is to develop models of how the bilingual's languages are acquired, represented and processed. Since research started in the field, researchers have met this aim with proposals such as the coordinate, compound, subordinate distinction, the one versus two lexicons hypotheses, the switch or monitor proposals, various models of lexical representation, ventures to describe written and spoken word recognition in the bilingual, and the fused versus separate language development models of simultaneous language acquisition. By their very existence, these theoretical contributions have been a real asset to the field in that they attempt to step back from data to give a general description of a phenomenon. In addition, they allow other researchers to confirm or invalidate certain predictions and hence propose variants or new models. Their advantages therefore far outweigh the problems, as will be seen below.

Problems

A first problem that is slowly disappearing is that some models still have a monolingual view of the bilingual individual. Instead of accepting that bilinguals are specific speaker-hearers who through the contact and interaction of two or more languages are distinct from monolinguals (Grosjean, 1985a; Cook, 1992), some researchers still use a monolingual yardstick to describe aspects of bilingual behavior and representation. Earlier work on the input and output switches (reviewed in Grosjean, 1982) was based in part on the notion that bilinguals had one language switched on, and the other switched off, but never the two switched on at the same time. And yet it is now recognized that in a bilingual language mode, both languages are active and the bilingual can produce mixed language utterances at the same rate as monolingual utterances (and, of course, decode them at that rate). This monolingual viewpoint can still be found in certain areas where it is expected that "dominant" bilinguals will behave in large part like monolinguals in their dominant language. Of course, this might be the case in some instances but one should be ready to accept bilingual specificities when they appear.

A second problem concerns the discrete classifications that are found in the field. For example, Weinreich's (1966) coordinate, compound, subordinate trichotomy and Ervin and Osgood's (1954) coordinate, compound dichotomy, triggered much research. But contradictory findings and theoretical considerations have led various researchers to move away from these distinctions and hypothesize that within the very same bilingual, some words in the two lexicons will have a coordinate relationship, others a compound relationship and still others a subordinate relationship, especially if the languages were acquired in different cultural settings and at different times. Recent work on lexical representation in bilinguals appears to defend such a position (see various chapters in de Groot and Kroll, 1997). The same kind of discrete classification problem can be found in the long debate that has surrounded the number of lexicons the bilingual possesses (reviewed by Grosjean, 1982). Paradis's subset hypothesis (1981, 1986) was instrumental in helping researchers view this question in a different light, and recent

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proposals of lexical organization such as the word association model and the concept mediation model (Potter et al., 1984), the revised hierarchical model (Kroll and Stewart, 1994) and the conceptual feature model (De Groot, 1992), have also contributed to an improved understanding of the organization of the bilingual's lexical representations. It should be noted though that some researchers still propose that distinct groups of bilinguals are best characterized by just one of these models (or variants of it). It is only recently that de Groot (1995), based on an extensive review of the literature, comes to the conclusion that *the* bilingual memory does not exist. The memory of every individual is likely to contain structures of various types and these structures will occur in different proportions across bilinguals. This will depend on factors such as level of proficiency of the languages known, the characteristics of the words, the strategy used to learn them, the context in which the languages are used, the age at which a language was acquired, and so on. In sum, one should be extremely wary of discrete classifications that do not do full justice to the representational and processing complexity found within the individual bilingual.

A third problem is that some models may not contain all the necessary components or levels needed. An example comes from recent work on lexical representation where most of the models proposed (see above) contain only two levels: a lexeme (or form) level and a conceptual (or meaning) level. And yet there is quite a bit of evidence in the literature that the lexicon contains a third level, the lemma level, that is situated between the lexeme and the conceptual level. Lemmas contain morphological and syntactic information about the word (Jescheniak and Levelt, 1994; Myers-Scotton and Jake, 1995). Just recently Kroll and de Groot (1997) have proposed to take this level into account and have presented the general outline of a distributed lexical/conceptual feature model of lexical representation in the bilingual that contains this level. At some point their model will probably have to take into account a fourth level (world knowledge) at least to explain the underlying operations that take place when participants are involved in paradigms that include nonlinguistic operations (such as picture naming). Paradis (1995) states, as he has done repeatedly, that one of the major problems in the field has been the failure to distinguish between the meaning of words and nonlinguistic representations. Based on research in neurolinguistics, he states that we must distinguish between the lexical meaning of words, which is a part of the speaker's linguistic competence, and conceptual representations which are outside implicit linguistic competence. (Note here that he uses the expression "lexical meaning" for what corresponds to the conceptual level in most models and "conceptual representation" for nonlinguistic, world knowledge.) He adds that the conceptual system, where messages are elaborated before they are verbalized in the course of the encoding process, and where a mental representation is attained at the end of the decoding process, remains independent and isolable from the bilingual's language systems. It would be interesting to know whether tasks such as word repetition, word translation and picture naming, for example, require access to this nonlinguistic level. Some must (e.g., picture naming), whereas others may not have to.

A fourth problem is that the field has too few global models that give a general picture of bilingual competence, bilingual production and perception, as well as bilingual language acquisition. For example, until de Bot's (1992) attempt at adapting Levelt's (1989) "Speaking" model to the bilingual, there was no general overall view of how the bilingual speaker goes from a prelinguistic message to actual overt speech. Even though de Bot's model still needs to give a clear account of how language choice is conducted, how the language mode is chosen and the impact it has on processing, how code-switches and borrowings are actually produced, how interferences occur, and so on, it has the very real quality of dealing with the complete production process and hence of encouraging debate in the field (e.g., de Bot and Schreuder, 1993, Poulisse and Bongaerts, 1994, Poulisse, 1997). This is true also of Green's (1986) resources model of production for normal and brain-damaged bilinguals. In the domain of perception and comprehension, no model as broad as Marslen-Wilson and Tyler's (1987) interactive model or Forster's (1979) modular model of language processing has been proposed. However, headway is being made by two computational models that are relatively broad: a bilingual model of visual word recognition (BIA; Grainger and Dijkstra, 1992; Dijkstra and van Heuven, in press), and a model of spoken word recognition in bilinguals (BIMOLA; Grosjean, 1988; Léwy and Grosjean, in preparation).

A final problem, which is admittedly in partial contradiction to the previous one, is that models are not always detailed or explicit enough. For example, Myers-Scotton (1993) has proposed a model, the Matrix Language Frame (MLF) Model, which states that a number of hierarchies, hypotheses and principles govern the structuring of sentences containing code-switches. The model has attracted the attention and the interest of linguists and psycholinguists but, like other important models, it has also raised many questions. For example, Bentahila (1995) states that

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it is not specific enough on such things as what constitutes a matrix language, the difference the model makes between an extensive embedded language (EL) island and a change of matrix language, what a system morpheme is, and so on. For Bentahila, models must be explicit and their validity depends on clear definitions which are externally verifiable without circularity.[3]

Tentative solutions

If there is one issue for which solutions can only be tentative, it is the one which deals with models. This is by far the most delicate and complex issue raised so far and what follows is only one researcher's view point. First, and from what has been said, it is clear that any model will have to take into account the full complexity of the bilingual speaker-hearer as illustrated in the first two sections of this paper (participants and language mode). For example, bilinguals should not be viewed as two monolinguals in one person or be classified once and for all in discrete linguistic or psycholinguistic categories. Second, it is crucial that general models be proposed. The field is in dire need of general theories of the bilingual speaker-hearer as well as of models of bilingual language acquisition and processing. Third, models must contain all the necessary components or levels needed and they must be as explicit as possible so that they can be put to the test. Fourth, it is important that cross-fertilization takes place between the various domains of bilingualism. A theoretical linguistics of bilingualism that attempts to account for the bilingual's competence, a developmental psycholinguistics that models how children acquire their two languages simultaneously or successively, a neurolinguistics of bilingualism that accounts for normal and pathological brain behavior, and a psycholinguistics that models processing in bilinguals can each bring a lot to the other domains and receive a lot from them. Finally, bilingual models will have to use, after being adapted, the new approaches and the new theories that are constantly being developed in the various fields of cognitive science primarily to study monolinguals. In return, these fields will be enriched by what is learned about bilinguals.

Concluding remark

Dealing with the methodological and conceptual issues that have been presented in this paper will take time, work and some inventiveness. The outcome, however, will be clearer and less ambiguous results as well as models that take into account the full complexity of the bilingual individual.

[3] It should be noted that Myers-Scotton (pc) reports that many issues raised by Bentahila are discussed and clarified in the "Afterword" of the 1997 paperback version of her book, *Duelling Languages* (Myers-Scotton, 1993).

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Received March 19, 1998 Revision accepted May 28, 1998

https://doi.org/10.1017/S136672899800025X Published online by Cambridge University Press