Linguistic Artificiality and Cognitive Competence

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Linguistic artificiality and cognitive competence

1. Introduction

Proponents of artificial and simplified natural languages for universal communication have faced numerous objections to the feasibility of such "planned" languages. We can fit most of these objections into two categories. The first category includes claims that the public support needed to secure the official or practical adoption of a planned language for common international use is impossible to obtain. The second category includes claims that no planned language could function adequately as the main medium of world-wide communication. In this research note, we are concerned with an objection belonging to the second category: the functional inadequacy of planned languages.

The inadequacy of planned languages has been asserted on several grounds. The two most persistently offered grounds appear to be diversity and poverty. By "diversity" we refer to the assertion that the world-wide uniformity required for successful operation of the language would erode with time: the language would split into mutually incomprehensible dialects. By "poverty" we refer to the claim that a planned language would limit the ability of its users to formulate and communicate ideas. It is this second objection to the feasibility of a planned language that we focus on in this research note.

We can summarize the "poverty" argument as follows: no person or group of persons knows enough about language to invent a new language (or even greatly simplify an existing language) with confidence that the product will succeed as a comprehensive medium of thought and communication. Natural languages have some known features that cannot be built into planned languages, such as high levels of redundancy, connections between terms and experiences, and meaningful stylistic variations. Moreover, so goes this argument, there

are other essential, but at present unknown, features of languages used for centuries that are missing from planned languages such as Esperanto or Volapük. Thus, attempts to use a planned language will result in unacceptable levels of unintentional miscommunication, frustrations caused by a perceived inability to communicate key concepts, and/or degradation of the tools of thought available to those who do their thinking in the new language. Arguments to this effect date back to at least 1930 (references in Large 1985: 188-189; Mead–Modley 1967; Orwell 1949; Timurtaş 1969) but have never been experimentally investigated.

Unspecified in the poverty argument are the mechanisms whereby the particular characteristics of planned languages produce the deficiencies in thought and communication. For example, if a planned language has low redundancy, why does this cause misunderstanding? And, if a planned language is grammatically simple, why does this limit the user's reasoning or judgment? There are numerous possible explanations for such purported relationships. We shall not attempt a conceptual or theoretical analysis of the poverty argument here. Rather, we shall ask whether a straightforward method for empirically testing its predictions can be developed. Our work on this problem will be confined to the prediction that the use of planned languages impairs their users' reasoning ability and thereby leads to observable biases in the judgments they make.

One approach to gathering evidence on this proposition is to observe the judgments of persons who already speak a planned language. There are "a few" speakers of Volapük (Blanke 1985: 213), about one-hundred speakers of Occidental (Blanke 1985: 167), about two-hundred speakers of Interlingua (Blanke 1985: 182), about three-hundred speakers of Ido (Blanke 1985: 199; Large 1985: 154), and a half-million speakers of Esperanto (Blanke 1985: 289; but see Piron, "Who are the speakers ...", in this volume – ed.). So the most obvious candidate for observation is the community of Esperanto speakers, which is about a thousand times the size of all other planned languages combined. The aggregate behavior of the speakers of Esperanto does not, however, clearly testify to any effects of the language on the reasoning ability of those who learn or use it. Were Esperanto speakers a linguistic cult, showing unanimous blind faith in the infallibility of the movement's leaders or doctrines, this judgmental inflexibility would at least be compatible with the hypothesis that the language impairs the reasoning ability of those who learn it. A degradation of reasoning ability as a result of the knowledge or use of Esperanto

would lead to the prediction that the judgments of fluent speakers would be more biased than the judgments of beginning speakers. The evidence does not clearly fit either of these patterns. Esperanto speakers differ greatly among themselves in political ideology (Blanke 1985: 288; Jordan 1987: 111-114), and their political opinions are generally not deviant (Forster 1982: 320-326). Impressionistic observation of the Esperanto movement reveals considerable factionalism, as well as acrimonious debate about principles, strategies, tactics, and linguistic theory. On the basis of what little evidence exists, it appears that Esperanto speakers are not, on the whole, unusually dogmatic, gullible, or illogical. Furthermore, no tendency for students of Esperanto to become less "rational" as they learn more of the language has been reported.

If the aggregate behavior of the speakers of the most frequently used planned language does not provide convincing evidence that use of Esperanto affects its users' reasoning ability, this is no surprise. "Although many have tried to do so, no one has successfully predicted and demonstrated a cognitive difference between two populations on the basis of the grammatical or other structural differences between their languages" (Fishman 1970: 92-94). Not finding such evidence is not the same as disproving the proposition, however. If previous experience is a guide (Fishman 1970: 97), the best evidence is likely to come from an experiment that controls for additional variables that are expected to influence subjects' reasoning ability.

Any experimental comparison between persons who speak and persons who do not speak Esperanto would be compromised not only by the many incidental differences that can be assumed to characterize any two speech communities, but also by the self-selection that helps define the membership of the Esperanto (as of any second-language) community. The main reward from the experimental method in this study is the ability to control for such differences. To achieve such control, we can measure the behavior of artificial-natural bilinguals, i.e., persons who are competent in both an artificial language (here Esperanto) and a natural language. While such a design sacrifices the opportunity to compare unilinguals, this sacrifice is not as serious in the study of planned languages as it would be in comparing, say, English and Zuni, since unilingual speakers of planned languages are nonexistent.

With this strategy in mind, a brief experiment was conducted at a site where numerous speakers of Esperanto could be found. In light of the poor regulation of the site conditions by the experimenters and the

impossibility of conducting a pretest to refine the stimuli, this experiment should be considered purely exploratory.

2. Subjects

The subjects in our field experiment were 135 persons attending the 69th World Esperanto Congress, held in July, 1984, in Vancouver at the University of British Columbia. Persons attending the congress were approached unsystematically in public places and asked (in Esperanto) whether they knew how to read both Esperanto and English. If so, they were invited to fill out an an anonymous questionnaire on the spot and return it immediately to the investigator.

3. Method

The questionnaire contained two reasoning problems and a question on whether the respondent could more easily read Esperanto or English.

The first item on the questionnaire was a test of deductive reasoning. Half the subjects received the item in English and half received it in Esperanto, the language being determined by randomization. The two versions read:

English: Every friend of a friend of Country A is a friend of Country A. Every friend of an enemy of Country A is an enemy of Country A. Every enemy of a friend of Country A is an enemy of Country A. Country B is an enemy of a friend of an enemy of Country A. Therefore (choose only the answer that logically follows):

[ ] Country B is a friend of Country A.

[ ] Country B is an enemy of Country A.

[ ] It is not certain whether Country B is a friend or an enemy of Country A.

Esperanto: Ĉiu amiko de amiko de Lando A estas amiko de Lando A. Ĉiu amiko de malamiko de Lando A estas malamiko de Lando A. Ĉiu malamiko de amiko de Lando A estas malamiko de Lando A. Lando B estas malamiko de amiko de malamiko de Lando A. Do (elektu nur la logike sekvan respondon):

[ ] Lando B estas amiko de Lando A.

[ ] Lando B estas malamiko de Lando A.

[ ] Ne certas ĉu Lando B estas amiko aŭ malamiko de Lando A.

The second item on the questionnaire was a test of consistency of judgment under uncertainty. Subjects receiving the first item in English received the second one in Esperanto and vice versa. This question, slightly adapted from one used by Tversky–Kahneman (1981: 453), began as follows:

English: It is expected that a certain disease will kill 600 persons. The ministry of health is considering two methods for opposing this disease. Which method do you prefer?

Esperanto: Oni atendas ke certa malsano mortigos 600 homojn. La ministerio pri saneco konsideras du metodojn por kontraŭi tiun malsanon. Kiun metodon vi preferas?

The remainder of the question (always in the same language) took one of two forms, randomly selected:

English, form 1:

[ ] Method A: it would save 200 persons.

[ ] Method B: the chances are 1/3 that it would save 600 persons and 2/3 that it would save no one.

English, form 2:

[ ] Method A: 400 persons would die.

[ ] Method B: the chances are 1/3 that no one would die and 2/3 that 600 persons would die.

Esperanto, form 1:

[ ] Metodo A: oni savus 200 homojn.

[ ] Metodo B: la ŝancoj estas 1/3 ke oni savus 600 homojn kaj 2/3 ke oni savus neniun.

Esperanto, form 2:

[ ] Metodo A: 400 homoj mortus.

[ ] Metodo B: la ŝancoj estas 1/3 ke neniu mortus kaj 2/3 ke 600 homoj mortus.

4. Hypotheses

The first item on the questionnaire is a question with three possible answers, one of which is correct and two of which are incorrect. The fourth premise in this item implies, by virtue of the second premise, that Country B is an enemy of an enemy of Country A. No premise, however, implies anything about an enemy of an enemy of a country. To illustrate, suppose that X is an enemy of A and that B is an enemy of X. B is thus an enemy of an enemy of A. Given this information, B might be a friend of A, an enemy of A, or neither a friend nor an

enemy of A. Even if a subject understood the text to imply that the relations of "friend" and "enemy" are symmetric (B is to A as A is to B) or exhaustive (A must be either a friend or an enemy of B), the correct conclusion would not change. Thus the third option ("It is not certain...") is the only correct answer. The prediction being investigated is that correct answers to this item will be more frequent among subjects reading the item in English than among subjects reading it in Esperanto.

The second item requires the subject to express a preference between two policies with uncertain outcomes. Neither policy can be described as the correct one. However, the item was presented in two forms with the same implications for the numbers of deaths that each policy could cause and the probabilities thereof. It seems reasonable to assume that a person manifesting high reasoning ability would answer this question identically regardless of the form in which it is couched. A person who is reasoning poorly would, on the contrary, be likely to give an answer influenced by the differential presentation of the question in the two forms. In particular, form 1 tends to bias subjects in favor of Method A, and form 2 in favor of Method B. As argued by Tversky–Kahneman (1981), these biases result from the different "anchorings" suggested by the two forms. Form 1 suggests that 600 deaths is the status quo, while form 2 implies that 0 deaths is the status quo. Form 1 thus asks the subject to compare a certain gain with an uncertain gain. Since the value of an uncertain gain tends to be underweighted, this form biases the subject in favor of the certain gain. Form 2 asks the subject to compare a certain loss with an uncertain loss. Since an uncertain loss tends to be underweighted (just as an uncertain gain is), this form biases the subject in favor of the uncertain loss.

In light of previous research, we should expect the majority of subjects given form 1 to choose Method A and the majority of subjects given form 2 to choose Method B. Failing that, we should expect that the proportion choosing A will be greater with form 1 than with form 2. This should be true regardless of the language in which the item is administered. Furthermore, the planned-language poverty argument predicts that the difference between the proportion choosing Method A in forms 1 and 2, i.e., the extent of the presentation-induced bias, will be greater among subjects reading the item in Esperanto than among those reading it in English.

Several characteristics of the sampled population could be expected to interact with the language variable in strengthening or weakening the hypothesized effects. Most prominent among these is the subjects' competence in the two languages. Subjects more competent in either language should be expected to show greater reasoning ability when that language is used in formulating a problem. Thus we can offer a "strong" version of each of the above hypotheses. In their strong versions, the hypotheses predict differences that will hold true even among subjects who are more competent in Esperanto than in English.

5. Results

The results for the first item are shown in Table 1.

Table 1. Language and deductive reasoning

Respondent better at English?	Yes		No		All	
Language of question:	Eng.	Esp.	Eng.	Esp.	Eng.	Esp.
Response (per cent):						
"friend" (incorrect)	18	32	21	39	19	35
"enemy" (incorrect)	9	19	12	13	10	16
"not certain" (correct)	73	49	68	48	70	49
(N)	(33)	(37)	(34)	(31)	(67)	(68)
χ^2 (incorrects pooled):	4.2		2.5		6.5	
Significance:	$p < .05$		$p < .2$		$p < .02$	

Consistent with the hypothesis, the proportion of correct answers was higher among those receiving the question in English than among those getting it in Esperanto. As further predicted, the advantage held by those receiving the question in English was greater among those who claimed to read English more easily than Esperanto, but it was present even among those who claimed to read Esperanto at least as easily as English, thus supporting the "strong" version of the hypothesis. Given the number of respondents, however, we cannot place much confidence in the reliability of this latter result, since a difference between the English and Esperanto versions at least this great would occur by pure chance in from 10% to 20% of random samples of this size if there were no difference in the population as a whole. Also, as we shall discuss below, respondents may have tended to overestimate their Esperanto competence relative to their English

competence because of the prestige accruing to Esperanto competence in the setting of the experiment.

The results for the second problem are shown in Table 2.

Table 2. Language and presentation effects

Respondent better at English?	Yes		No		All	
Language of question:	Eng.	Esp.	Eng.	Esp.	Eng.	Esp.
Per cent selecting Method A:						
On form 1	74	43	53	47	65	44
(N)	(19)	(21)	(15)	(15)	(34)	(36)
On form 2	28	17	50	32	38	26
(N)	(18)	(12)	(16)	(19)	(34)	(31)
Difference:	46	26	3	15	27	18
ϕ:	.46	.27	.03	.15	.26	.19
χ^2:	7.8	2.4	.03	.81	4.8	2.5
Significance: $p <$	.01	.2	.9	.5	.05	.2

As Table 2 shows, the data support the first part of the hypothesis but not the second. Within each language-competence group, the proportion selecting Method A was greater on form 1 than on form 2, consistent with prior findings on this presentation bias. The between-form differences, however, were greater among those receiving the question in English, not (as hypothesized) among those receiving it in Esperanto, for the subjects taken as a whole. When we consider the two competence groups separately, we find that each group experienced a greater presentation bias in its better language, again contradicting the predicted relationship.

Assuming that a complete presentation bias would mean all form-1 responses being Method A and all form-2 responses being Method B, we can also use the ϕ statistic to measure the extent of the presentation bias. ϕ can range from -1 (a complete presentation bias in the direction opposite to the expected one) through 0 (equal proportions of Method A on the two forms) to $+1$ (complete presentation bias in the expected direction). The values for ϕ in Table 2 are consistent with the arithmetic differences. As with the data on the first hypothesis, not all these results are statistically significant. Thus some of the between-form differences are small enough to occur often by chance in random samples drawn from a population exhibiting no between-form differences. However, if there were a consistent and large language effect in the predicted direction among the congress participants as a whole, sample results as deviant as these would be very unlikely.

6. Discussion

The results presented above yield contradictory evidence about the proposition that use of an artificial or simplified language will restrict reasoning ability in comparison with use of a natural language. A test of deductive reasoning was answered more successfully in English than in Esperanto. However, a test of resistance to presentation-induced bias was passed with greater success by those reading the problem in Esperanto than by those reading it in English.

What might account for this apparent contradiction? One explanation would be based on the subjects' relative competences in Esperanto and English. There is reason to suspect that subjects tended to overreport their relative Esperanto competence. Esperanto speakers among themselves tend to be embarrassed by admitting nonfluency in Esperanto, so we should expect self-reported Esperanto competence to be exaggerated more than self-reported English competence in this context. If it was, many whom we classified as Esperanto-dominant may have been English-dominant and thus more able to process a logical reasoning task in English than in Esperanto.

But, while inhibiting logical reasoning, relative deficiency in a language may tend to protect speakers against presentation biases. We know that persons tend to exhibit presentation-bias effects in their native languages, so competence in a language does not prevent such effects. Perhaps incompetence in a language tends to suppress them, simply by reducing the ability to perceive the meaning differences that varying presentations communicate. We noted above the curious result that each language group exhibited more bias when using the language of its greater competence, rather than when using its weaker language. This finding suggests that some respondents avoided succumbing to a presentation bias only by reading the question in a language they could not easily understand. At the limit, total incomprehension of the stimulus would result in equally distributed answers on the two forms, leading to a finding of no presentation bias at all.

This explanation calls attention to the epistemological problem of relating language competence with reasoning ability. Objective measurement of competence must arguably involve tests such as the very one whose results we think may be a function of competence; in other words, the obvious method for assessing competence in a language is to ask questions in that language and measure the correctness of the testee's answers. If so, we may be unable to

disentangle completely the dependent variable, reasoning ability, from the control variable, language competence.

A second explanation for a higher incidence of deductive mistakes in Esperanto would be the associations between languages and cognitive orientations. It is possible, as Ervin (1964: 381) points out, "that a shift in language is associated with a shift in social roles and emotional attitudes. Since each language is learned and usually employed with different persons and in a different context, the use of each language may come to be associated with shift in a large array of behavior." In particular, Esperanto is likely to be associated, among its speakers, with international friendship. Thus, when they are communicating in Esperanto they may be biased toward drawing the conclusion that Country B is a friend of Country A, or they may assume that the experimenter desires to hear this conclusion, regardless of its validity. A further look at Table 1 lends support to this explanation. Among subjects reporting more competence in English, both of the incorrect answers were substantially more frequent in Esperanto than in English. But among those reporting at least equal competence in Esperanto, only the "friend" answer was substantially more frequent in Esperanto than in English. This finding suggests that, as members of the Esperanto speech community become more fluent in this planned language, they undergo two changes. First, they become better able to solve logical problems when posed in the language. But, second, through the increased exposure to the Esperanto movement that typically accompanies increased fluency, they become more committed to the ideology of the movement and hence more susceptible to making invalid deductions when these are suggested by this ideology. In further investigations it would therefore be advisable to control for whether the topic of the problem is clearly associated with one or the other of the languages concerned.

A more difficult-to-detect association that could explain the same result is one linking English but not Esperanto to the very activity of deductive reasoning itself. Such a differential association would be reasonable to expect. The predominant motivation for the study of English appears to be "instrumental", in contrast with "integrative" motivations underlying the study of Esperanto (cf. Gardner–Lambert 1972: 11-16). English is apparently used in problem-oriented contexts more than Esperanto. It is possible that, purely because of such differential motivations and experiences, subjects reason better when using English than when using Esperanto; that they would do so regardless of the grammatical features of the two languages (cf. Laitin

1977: 181); and that alteration of the topic would not normally eliminate this difference. Still, there are some topics that do evoke a deductive orientation in Esperanto (e.g., grammatical categories of Esperanto lexemes). Thus we might expect that such topics would reduce the English-Esperanto difference in performance on deductive reasoning tasks.

A further finding shown in Table 2, unpredicted by any of the theories we have considered, is that subjects reading item 2 in Esperanto more frequently chose Method B, the one with risky outcomes, than did subjects reading it in English. This was true for both forms of the problem in both language-competence groups. Those using Esperanto thus showed a greater risk acceptance, i.e., a greater willingness to take a chance rather than choose a policy with a known outcome. Why might Esperanto produce more risk acceptance than English? As a mere speculation, we can imagine that Esperanto itself, as a "long-shot" candidate for the role of world language, is associated with risk acceptance more than English is. This unexpected finding clearly calls for a more definitive confirmation.

Our experimental results, though inconclusive, suggest that the associations between particular languages and particular beliefs and orientations may cause bilinguals to alter their reasoning style as they shift from one language to another. These associational effects may be difficult to distinguish from putative effects of redundancy, grammatical complexity, and other structural features of languages on the reasoning ability of their speakers. In the case of Esperanto-English bilinguals, problem-solving behavior was not consistent with the claim that an artificial or simplified language is pervasively inferior to a natural language as a medium of thought and communication. On the other hand, the pronounced tendency for subjects using Esperanto to draw the fallacious conclusion that one country was a "friend" of another country suggests, contrary to claims by some of its advocates, that Esperanto is not a "logical language" if the term implies that the language banishes illogic from the minds of its users. However, because our sample was not a random one, and because conventional levels of statistical significance were not reached for most of the differences we report, as noted earlier, our findings can only be taken as suggestive.

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