THINKING IN JAPANESE? WHAT HAVE WE LEARNED ABOUT LANGUAGE-SPECIFIC THOUGHT SINCE ERVIN TRIPP'S 1964 PSYCHOLOGICAL TESTS OF JAPANESE-ENGLISH BILINGUALS?

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Dr. Steve Henser has lived and worked for twenty years in Japan. He did his graduate work as an external research student at the University of London, and was awarded the doctorate in December, 2000. His doctoral dissertation was entitled, "Natural language use in habitual propositional-type thought (Support from Japanese-English and English-Japanese bilingual covert code switching data)", and addressed the question of whether humans use a non-natural language ("Mentalese") form of representation in thought, or whether at least some of human thought actually takes place in natural language.

This paper was presented at the Nissan Institute on 20th October, 2000.

Mark Rebick
Editor

Thinking In Japanese? What Have We Learned About Language-Specific Thought Since Ervin Tripp's 1964 Psychological Tests Of Japanese-English Bilinguals?

Abstract

In the mid-1960s, Susan Ervin-Tripp, one of the pioneer figures in the then newly-developing field of psycholinguistics, performed a series of tests on Japanese-English bilinguals with a view to probing the cognitive organisation of the bilingual brain. Ervin-Tripp found that bilinguals have separate semantic and associative networks for each of their languages, suggesting still further the interesting questions, such as: Do bilinguals have separate language-specific mind-sets? Does at least some human thought take place in natural language? These questions have recently come into sharper focus as a result of an on-going debate between Jerry Fodor (Rutgers University: advocates a non-natural language specific innate "Mentalese") and Peter Carruthers (Sheffield University: advocates natural language as the format of at least some human propositional-type thought). This article reviews the progress made towards a resolution of these questions, including original experimental work by the author.

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1. The Inner Life of the Bilingual

As changes in communications technology and the global economy close the gap between nations, and as the international community is described with increasing accuracy as a 'global village', the issues of multiculturalism and multilingualism assume proportions such as compel even those countries, such as Britain and Japan, which had formerly thought of themselves as 'island nations' to sit up and take notice. Needless to say, these questions, like other issues, have more than one side or perspective deserving of our attention. If we were to liken the issue of multilingualism/multiculturalism to a telescope, two obvious perspectives would spring to mind: the macro perspective - looking from the metaphorical "eyepiece" outwards to examine the wider implications of changing cultural and linguistic habits upon society as a whole, and then there is the other end of the "telescope", what might be called the micro perspective, where one looks at the smallest possible unit in these equations, *viz.*, the mind of the individual effected by these linguistic habits.

In this monograph, it is this latter perspective which will determine the direction of our examination. Specifically, we will take a look, from a psychological perspective, at the question of how becoming bilingual affects the way a person thinks, and examine the rôle of, and importance of language in cognition.

Bilinguals are often asked questions by their monolingual friends - questions such as, "What language were you thinking in when you spoke to me just then? Do you ever dream in Japanese/English etc.?" The intuitive answers to those questions may seem quite straightforward but, as we shall see, the trend in orthodox psychology until quite recently has been one in which the matter of whether there is such a thing as language-specific thought has been called into question, and so some deeper probing needs to be done if we are to give informed answers. Also, the question as to the nature of the language/thought relationship holds serious implications for the direction and focus of psychological research. We therefore do well to carefully weigh the findings of researchers in this field before we draw any conclusions.

2. Two views of the language/thought relationship

First of all, we might do well to clearly delineate in our minds two views which have informed researchers in the psychology of bilingualism, *viz.*, the two contrasting views of the bilingual language/thought relationship illustrated in Figure 1. View 1 illustrates what might be called the ***Communicative Thesis*** wherein the bilingual has one common conceptual store which s/he draws on in thought, and 2 L-specific mental lexicons for each of his/her Ls which are only utilised when that thought needs to be clothed with words for the purposes of interpersonal communication. Popular psychologist Steven Pinker (Pinker, 1994), Rutgers philosopher Jerry Fodor (Fodor, 1975, 1978, 1983, 1987, 1998) as well as many researchers in the field of bilingual studies, take this view of the language/thought relationship. In contrast with this position, we also have the ***Cognitive Thesis,*** illustrated in the lower half of Fig. 1, in which the bilingual individual has two L-specific cognitive stores which s/he calls on, not only for the purpose of communication, but also in his/her inner mental life. Exponents of versions of this view include philosophers Daniel Dennett (Dennett, 1993) and Peter Carruthers (Carruthers, 1996, 1998a, 1998b) and psychologists such as Alan Paivio (Paivio, 1986; Paivio and Desrochers 1980).

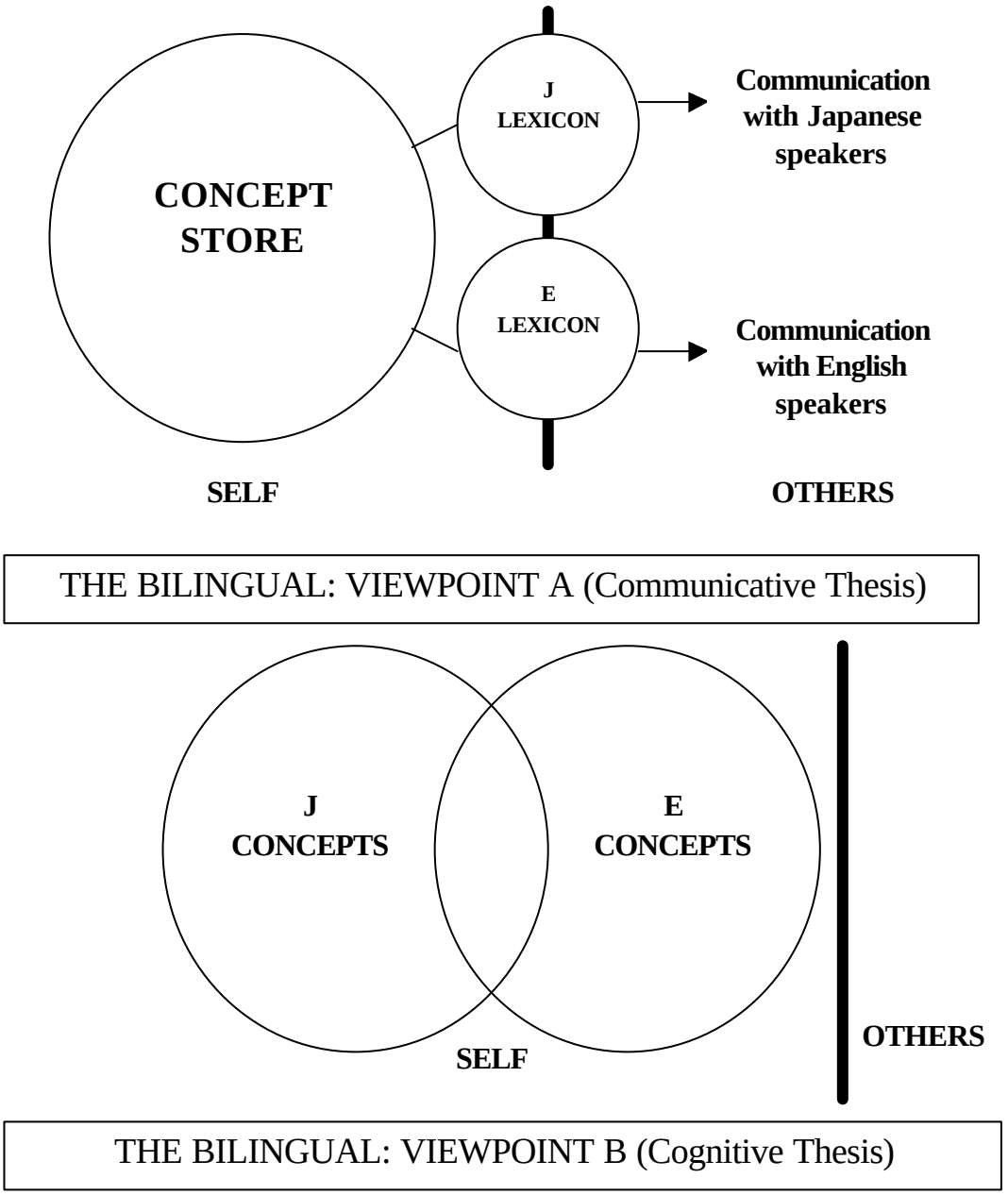

Fig. 1: Two Views of the Language/Thought Relationship in Bilinguals (using the example of a Japanese-English bilingual)

With these two contrasting viewpoints in mind, we are now in a positions to examine some of the research that has been done with a view to shedding light on these questions, along with the trends that have influenced this research and prospects for future progress towards a more complete understanding.

3. Questions raised by Ervin-Tripp's findings: Switching mental channels when switching language?

Students and researchers in the field of Japanese Studies will find it worth noting that one of the pioneer researchers to do serious work on these questions of bilingual cognition did much of her research using Japanese-English bilingual subjects. Psychologist Susan Ervin-Tripp, along with Noam Chomsky[1] and Charles Osgood, was one of the major figures in the then-developing field of psycholinguistics and bilingual studies back in the mid 1950's, a position which she still occupies at the beginning of this twenty-first century, despite her advancing years.

Ervin-Tripp conducted some very interesting groundbreaking research back in the 1950s and '60s on bilingual cognition. Largely working with bilingual Japanese women married to American men, she administered a series of psychological experiments over a period of years. Some of these experiments used sentence completions tasks, others a test that psychologists call TAT (the Thematic Apperception Test), whereby subjects are shown a set of pictures and asked to give an account of what they think each picture illustrates.

In each of her tests there was a time lapse of some months between testing subjects in each of the two language conditions to prevent interference from subjects' previous recollections of their performance in their other language. Order and other possible confounding variables were controlled for. The interesting finding of this series of experiments was the fact that bilinguals have separate semantic and associative networks for each of their languages (Ervin, 1955; Ervin-Tripp, 1964a, 1964b). So, for example, the word associations and images conjured up for a Japanese-English bilingual individual encountering the English word "moon" were not the same as that conjured up for <u>that same</u> individual when encountering the Japanese word *tsuki* or, to chose another example the associates evoked by the

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[1] As to the pioneer and pivotal rôle Chomsky played in the early days of the history of psycholinguistics. See Kess, Joseph F. (1992). See especially chapter 2 "A History of Psycholinguistics" *passim*. Also see *A Dictionary of Philosophical Terms and Names*, under Chomsky, Noam Avram. Available online. URL= http://www.philosophypages.com/dy/c2.htm#chom and the following extract abstracted from the Grolier Encyclopaedia under the heading, "Psycholinguistics". Also available online. URL= http://acnet.pratt.edu/~arch543p/help/psycholinguistics.html

English word "freedom" are not the same as those called forth for the same individual by the Japanese word *jiyû*. Around this same time, Paul Kolers also did some work on interlingual word associations. He reinforced Ervin-Tripp's findings and showed that these differences in mental networks were not merely a product of different associative/connotative/affective connections (things peculiar to the individual), but were also the result of different semantic networks, or different organisations of meaning in the bilingual brain (Kolers, 1963). The findings of Ervin-Tripp and Kolers gel nicely with the observations of Japanese clinical psychologist Takeo Doi in his book *The Anatomy of Dependence* (1973; original *Amae no Kôzô*, 1971). Doi showed that one could not fully understand or analyse the unique concepts of a culture without a knowledge of its language, and also pointed to unique webs/networks of language-specific concepts such as those which link together such concepts as *amae*, *sumanai*, *giri* and *ninjô*

Based on the experimental findings just described, as well as her own extensive naturalist observations, Ervin-Tripp concluded that bilinguals were, in essence, two persons in one mind - not, of course, in the pathological sense of being schizophrenic, but that they possessed two sets of concepts and mental networks - two "mental channels" - each of these associated with one of their two natural languages. Whilst conceding the possibility of other factors, such as culture, in thus shaping the bilingual, she hinted strongly that there might be a causative rôle for language in bringing into being persons with two slightly different language-specific mind sets. However, she left the final answer on these matters as open questions for future research.

4. How near have we come to answering the questions left for us by Ervin-Tripp?

So then, does language shape thought? Do we only use language for communication, or do we think in natural language?

Much has been said in the way of documenting the phenomenological sensation that bilinguals often report of "changing mental channels" when switching languages. Prominent bilingual studies researcher and editor of the journal *Bilingualism:*

Language and Cognition, Françoise Grosjean has spoken of the way bilinguals feel different persons when speaking their different languages, and Anna Wierzbicka (Australian National University) has referred to the way that the lexicons of different languages do indeed suggest different conceptual universes, and has documented what she describes as the "double life" of a bilingual (Grosjean, 1982; Wierzbicka, 1985, 1992).

4.1 Trends in orthodox scientific psychology till the early nineties which obscured serious research into these issues

Whilst bilinguals and bilingual researchers always suspected that there was such a thing as thinking in natural language, switching language-specific mental channels and an influence of natural language over thought (for an example of comments on the "orthodox" view in linguistics and psychology toward the idea of an influence of language over thought, see Bloom, 1981), despite all this, the path of scientific progress has unfortunately not been a universally straight one (cf. Kuhn, 1970, *passim*), and the *zeitgeist* in orthodox scientific psychology from the late sixties down till the early nineties tended to obscure serious research into these questions.

Several factors may have been involved in this trend: 1. There may have been an implied underlying feeling that the theory of linguistic relativity - the idea that specific languages may influence the way their speakers think (principal advocate Benjamin Lee Whorf [1897-1941]) - somehow runs counter to the fundamental psychological unity and equality of mankind. 2. The influence of psycholinguist Noam Chomsky and the Chomskyan school of thought with its search for linguistic universals. 3. The influence of Swiss psychologist Jean Piaget (1896-1980) who argued that a large amount of cognitive development takes place in the prelinguistic period. This emphasis worked against looking to language as a shaping factor in cognition. 4. A move towards viewing mental representations as non-language specific (more about that later).

4.2 Reasons why the concerns of scientific psychology orthodoxy were not justified

In actuality, there never was much substance in any of these so-called reasons for avoiding facing up to seriously examining the concept of an influence of specific languages over thought. By way of counter-argument to the misgivings of the universalist camp, we might point to the following:

Universals do not preclude the existence of diversity. Although there may be certain parameters that define the limits of human cognition as a whole, this does not *ipso facto* preclude the possibility for great variety within those parameters. To employ a crude illustration: there may be certain genetic boundaries that define what constitutes "vegetation", or "flowers", but we can be thankful that any such boundary does not preclude the vast and diverse array of vegetation and flowers which both bring delight and rest to our eyes and pleasure to our taste buds.

Diversity can sometimes mean the other person's language-shaped world-view can be better than one's own. An case in point here involves the work of the principle modern exponent of the theory of linguistic relativity, Benjamin Lee Whorf (1897-1941). Whorf did most of his research among the American Indian peoples, especially the Hopi Indians. Despite the prejudices of those of his generation, Whorf was a great egalitarian who positively evaluated the American Indian culture. He also held that *their* languages were in some ways better suited to the task of accurately representing physical reality than English was.

Also, calling on Chomsky in the defence of the anti-relativity cause was a mistake. Chomsky left room for the idea of specific languages triggering parameters in human cognition. It therefore follows that, espousing a Chomskyan stance does not, of itself, preclude the idea of relativism.

Recent research shows that there are probably a number of different types of knowledge representation. The existence of pre-linguistic forms of primitive representation is not an argument against linguistic thought.

4.3 Recent positive re-evaluation of the rôle of language in cognition

Since the 1980s, and more particularly the 1990s, there have been noticeable stirrings within psychology towards a positive re-appraisal of the linguistic relativity theory and its positive contribution to the understanding of bilingual phenomena. Amongst such stirrings, we might include:

The 1991 *Psychological* Review article by Hunt and Agnoli, and a subsequent article by Hunt and Benaji (1987) detailing the effects of language differences on memory, attention and awareness.

The work of John Lucy (1992a, 1992b) who examined differences between characteristic ways of speaking in Yucatec (the Mayan language), an indigenous language of south-eastern Mexico, and English and the cognitive performance of those two groups of language users. Lucy looked the way the grammars of these two languages treat nominal number and tested for cognitive effects using non-linguistic picture stimuli. He found that there were significant differences in the way the two groups attended to number that paralleled the features of these two languages.

Steve Levinson's field work among the native speakers of the Mexican Indian of Tzeltal (Levinson, 1997, 1998). Unlike our western languages, Tzeltal lack words that we use to describe egocentric spatial orientation - put more simply, it has no words for *right* or *left*, only words for absolute spatial coordinates such as north, south, east and west. Using non-verbal visual array stimuli, Levinson tested subjects to see whether the characteristics of their language were mirrored in the way they solved visual puzzles. As predicted, there was a highly significant degree of correlation.

The question that we might ask ourselves at this point is: *why* should we be consistently seeing proof of an influence of language over cognition? What mechanism underlies this influence? In this regard, it is fascinating to see the way psychologists have been getting gradually nearer and nearer to admitting the possibility of their being such a thing as language-specific thought - thinking in natural language.

For example, Willem Levelt constructed a 3-tier model of speech production consisting of a Conceptualizer, a Formulator and an Articulator, and said that it would be reasonable to expect bottom-up language specific influences, including an influence on conceptualisation during speech production (Levelt, 1989). Dan Slobin has also spoken (Slobin, 1996) of an "on-line" influence of language over thought at the point of speech production. Steve Levinson has gone further in suggesting the existence of "anticipatory" effects of habitual language use on thinking patterns (Levinson, 1997, 1998).

5. The thought-provoking Fodor/Carruthers debate: Mentalese vs. Natural Language-based propositional thought

Now we come to a milestone in determining the direction that research into the language/thought relationship would take. Philosopher Jerry Fodor has long held (Fodor, 1975) the position that human thought takes place in an amodal, non-natural-language-specific "Mentalese", and that natural language is merely a tool for use in interpersonal communication. Philosopher Peter Carruthers (Carruthers, 1996, 1998) has now challenged that viewpoint, and has raised the interesting possibility that many of our propositional thoughts may actually take place in natural language (a position that might be termed the TNL, or Thinking in Natural Language thesis) - a thesis with profound implications for both linguistic relativity and for explaining the "switching mental channels" first hinted at by Ervin-Tripp. Here, then, are the two positions of the two major protagonists of this debate:

Jerry Fodor believes that: humans & animals think in a *Mentalese,* or Language of Thought (LOT) and regards *Mentalese* to be an innately endowed data format. As Fodor sees it, humans use *Mentalese* to compute the meaning of data that they take in from their surroundings, including computing the meaning of natural language words. He portrays *Mentalese* as universal and, importantly (from the point of view of our discussion) *non-natural language-specific*. Natural (or "public") languages, such as English, Japanese or Spanish, exist solely for the purpose of overt interpersonal communication, whereas *Mentalese* is for thinking which Fodor sees as a global process, associated with central cognition. In contrast, natural/public languages are relegated to the level of processing by means of an informationally

encapsulated peripheral mental module. Fodor believes that natural/public languages cannot qualitatively enhance the cognitive capacity of their users, as the former (natural/public language) is learned and the latter is innate and, as the privately language (i.e. Mentalese) is used to compute the meaning public languages, it (innate Mentalese) must be at least as rich a knowledge representation system as the public languages themselves.

Peter Carruthers believes that: there are number of different knowledge representational systems - such as the propositional, the visuo-spatial and the kinaesthetic systems. He agrees with many of the proponents of the Language of Thought thesis in acknowledging that the Propositional Representational System[2] is language-like. The language of propositional thought (at least of conscious, and possibly also of unconscious propositional thought) is *not* Mentalese, but natural language (i.e. Japanese, English etc.). Carruthers envisages propositional thought as taking place by central cognition accessing and manipulating the higher-level units of meaning in the language mental module, and that therefore natural languages forms an integral part of such propositional-type thought. To support this argument, Carruthers points to a precedent that exists for central cognition to use higher-level units of knowledge representation from other mental "modules". This happens with the use of visual data in creating mental images. Therefore, claims Carruthers, central cognition may also use the higher-level (or *logical form* - LF for short) units of representation from the language module (or quasi-module) to facilitate cognition. Natural language exists, therefore, not merely for the purposes of overt communication, but has a cognitive rôle; it enhances cognition.

The Fodor/Carruthers debate has helped bring many of the key issues surrounding the language/thought relationship into focus. The answers to the questions they posed are directly related to the problem that Ervin-Tripp left us, namely, the nature of cause of the bilingual's twin mental networks. These answers also are vital in determining where to expend research energy in scientific psychology. As Carruthers has pointed out (Carruthers, 1996), if natural language is indeed the language of thought, it needs to be put on centre stage as an object of psychological investigation.

6. Some empirical research into the TNL (Thinking in Natural Language) Theory

The Russian psychologist **Soholov** was one pioneer worker in this field. In the early 1970s Soholov drew on findings of earlier Soviet researchers such as Lev Semenovich Vygotsky (1896-1934) who had emphasised the key rôle of language in concept formation and the use of "inner speech" in thinking and reasoning.

Soholov, along with other Soviet psychologists, did follow-up work based on Vygotsky's observations on the role of inner speech. Soholov, in particular, used the electromyogram and the electroencephalogram to investigate the state of subjects' speech organs and brain electrical activity during thinking, and also tested their performance of mental activity while subjected to articulatory interference (Soholov, 1972). He concluded that fragmentary inner speech was regularly involved in thinking as a kind of shorthand for what he described as 'verbal reasoning' (thought using the semantic representations of language, but with invoking the speech organs at sub-vocal level), and that difficult activities, such as understanding texts involving abstract reasoning, required longer continuous passages of "unfolded" inner speech ("inner talking") (Soholov, 1972).

A more modern version of what Soholov did can been seen in the field of brain imaging studies. These studies have shown that, when experimental subjects are asked to engage in mental imagery, they use modality-specific cortical systems (Martin, Wiggs, Ungerleider and Haxby, 1996; Simos, Breier, Zouridakis and Papanicolaou, 1998; also see summary in MacWhinney, 1999, pp. 23-26). McGuire and his colleagues (McGuire, Silbersweig, Murry, David, Frackowiak and Frith, 1996; also cf. Smith, Reisberg and Wilson, 1992 and Smith, Wilson and Reisberg, 1995 on the rôle of the "inner ear" and "inner voice") have extended this research to include covert use of language in inner speech. McGuire and his colleagues measured the neural correlates of inner speech (where subjects generated short mental sentences without overt speech) and auditory verbal imagery (where subjects imagined sentences being spoken to them in another person's voice) using positron emission tomography (PET). Inner speech was seen to involve activity in an area concerned

with overt speech generation, while imagining speech is associated with activity in regions associated with speech perception[3].

A number of studies have been made into the phenomenon of bilingual aphasia, or speech loss by bilinguals. Of those researchers who studied incidences of non-parallel and even selective recovery of the language systems of bilingual/polyglot aphasiacs (e.g. Paradis, 1977; Albert and Obler, 1978), Chary showed a relationship between pre-morbid inner use of natural language and non-parallel recovery, and was able to demonstrate that the language best recovered was one and the same as the language that the bilingual previously used in habitual thought/inner speech activities such as prayer (Chary 1986). Chary's work thus served to strengthen support for a cognitive rôle for language in the inner mental life of its users.

Professor of Psychology at MIT Elizabeth Spelke (who is one of today's principal researchers in the field of developmental psychology), together with her colleagues at Cornell has recently been doing some fascinating research into the sources of flexibility in human cognition, research that points clearly to a key rôle for natural language in cognition. (Hermer-Vazquez, Katsnelson and Spelke, 1999). Spelke and her colleagues put together an ingenious series of dual-task experiments that examined the way that pre-linguistic humans and rats on the one hand, and adult humans on the other, deal with problems involving various types of spatial orientation. They found that there were a number of possibly modular forms of data representation employed in spatial orientation - e.g. geometric (shape) data representation and colour representation. Whilst all groups - pre-linguistic infants and rats, as well as adult humans - possessed the ability to utilise these various types of data, only humans with developed language abilities can synthesise data from the various sources in a flexible way. We can tell this from the fact that when the inner use of language by adults is artificially interfered with by giving experimental subjects tasks such as verbal shadowing (where subjects have to repeat words immediately after hearing them), this ability to synthesise data flexibly is drastically

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[3] Inner speech was associated with increased activity in the left interior frontal gyrus. Auditory verbal imagery was associated with increased activity in the same region and in the left premotor cortex, the supplementary motor area and the left temporal cortex.

reduced. By contrasting the disruptive effects of verbal tasks with the effects of non-verbal tasks such as orally repeating or hand-tapping out a rhythm, Spelke was able to demonstrate that the results of her experiments were not a product of such confounding variables such as conflicting demands on general cognitive abilities such as memory and attention, but were in actuality language-specific effects. Spelke concluded that language definitely is being deployed in cognition and that (*pace* Fodor) it qualitatively enhances non-verbal cognitive abilities by enabling the synthesis of otherwise un-synthesisable data, and that, in turn, this ability makes it possible for language-using adult humans to solve problems in a flexible way not available to animals or pre-linguistic infants.

Henser has also done extensive research into covert use of natural language in bilinguals[4] (Henser, 1999, 2000a, 2000b, 2001). Henser's earlier research (Henser, 1999) concerns bilinguals' own awareness of their conscious use of natural language in inner speech. Henser conducted a survey of 23 Japanese-English/English-Japanese bilinguals during 1997/8. 23 informants (11 E-J, 11 J-E bilinguals and 1 Chinese-J-E trilingual), 14 females and 9 males, with a mean age of 34.6 years. All except two respondents were either college graduates, or third or fourth year undergraduates. Three were working part-time as interpreters (J and E as their working languages).

With a view to ascertaining Respondents' level of bilingual ability, and bearing in mind Fishman and Cooper's (Fishman and Cooper, 1969) findings about the highly predictive value of self-assessment of bilingual skills with well educated respondents (see also Albert and Obler, 1978), Henser included a section in his questionnaire in which Rs could rate themselves on a ten-point scale (1 = poor, 10 = native-speaker ability) over four language modes in each of their languages: understanding spoken speech, speaking, reading and writing. The questionnaire was administered by mail, and then follow-up correspondence and/or interviews were conducted to clarify the meaning of respondents' answers.

In a key section of the questionnaire questions were propounded to test R's awareness of alternate use of their natural languages in thought. Questions such as, "When thinking privately, irrespective of whether or not your lips moved, have you

ever been conscious of ‘saying’ words to yourself silently?”, “When working on a difficult problem, are you ever aware of carrying on a ‘mental conversation’ with yourself…if so, in what language?” “When you have been speaking in one language for a long period, do you still find yourself thinking in this language after the conversation is over? (e.g., you have been conversing for a while in Japanese. After the conversation, you are driving your car and another car almost runs into you. Do you mentally - i.e. silently - execrate the other driver in English or in Japanese?)”. The following table (Table 1.) shows the main features of the informants’ answers:

Table 1. Characteristics of Subjects Answers to Questions in Henser's Survey

Characteristics of Rs' Answers (numbers in parenthesis do no necessarily correspond with numbering of questions in the questionnaire)	**No. of Rs**	**% of total (=23)**	**Comments**
(1) Found L_x cultural concepts/concepts with unique L_x flavour difficult to translate	18	78.3	
(2) Remembered L_x experiences in L_x	**20**	**86.0**	
(3) Translation more mentally demanding than speaking in L_2	22	95.7	R23 was the only exception here, but she claimed to have had no experience with translation.
(4) Experienced some form of 'warming-up' after using L_x after a prolonged period away from the L_x	17	73.9	Of those six Rs who were not aware of this experience, four had never been away from either of their language environments for any extended period since L_2 acquisition and the remaining two had low levels of L_2 ability.
(5) Were aware of making covert use of natural language in thought	**23**	**100.0**	**<u>All</u> Rs were conscious of covert/internal use of language.**
(6) Made covert alternative use of natural language (i.e. engaged in covert code-switching)	**19 [22 out of 22 - see comments in right hand column]**	**82.6 [100%]**	**If answers of R5, R7 and R20 are interpreted consistent with their replies to question 17, and if R15 data is excluded due to low L_2 ability, the figures on the left become 22 out of 22 and 100% respectively.**

Characteristics of Rs' Answers (numbers in parenthesis do no necessarily correspond with numbering of questions in the questionnaire)	**No. of Rs**	**% of total (=23)**	**Comments**
(7) Still thought in L_x after a period of L_x speech	**16**	**69.6**	
(8) Aware of behavioural changes accompanying a switch between Ls	17	73.9	Some examples of behavioural changes given by Rs were: greater consciousness of relative social positions when using Japanese and a feeling of greater lack of reserve when using English - expressed either in increased friendliness or increased aggressiveness.
(9) Use L_x body language/gestures when employing L_x in speech	16	69.6	
(10) Noticed changes in atmosphere of conversation with a shift in Ls.	10	43.5	

Of direct significance to the present study are points numbers 5 and 6. By their affirmative answers to a number of questions such as those mentioned in the sample provided, 100% of respondents registered the fact that they were aware of times (such as when thinking problems through, when 'lecturing' themselves to do something or other, or other such inner monologues/dialogues) when they covertly used natural expressions in thought. On the matter of covert code-switching, that is to say a bilingual's making alternate use of his/her languages covertly in thought, 19 respondents (82.6% of the total) said that they were aware of such covert code-switching while four respondents (respondents numbers 5, 7, 15 and 20) claimed not

to be so aware. Whilst the replies of these four respondents might be seen as detracting from Henser's position in conducting this study, it is of interest to note that three of these respondent (R5, R7 and R20) effectively negated their claim not to be aware of covert code-switching by answering question number 17, listed above, in the affirmative. The remaining respondent (number 15) had the poorest L_2 rating of any of the bilinguals and, if her data were to be deducted as irrelevant and that from respondents 5, 7 and 20 reinterpreted in line with their response to question 17, this would also give a 100% figure for covert code-switching by the population of bilinguals sampled in the survey.

To recap: 100% of respondents were aware of using natural language covertly in their private thoughts at times. 82.6% were aware of covert code-switching, and the remaining 17.4% could be added to this figure by virtue of their having registered the fact that they used their languages alternately in inner speech, at the very least when accessing items in their memory store, and also, in the majority of cases, when working on difficult problems, engaging in mental dialogues and the like.

This methodology was, by virtue of its nature, only able to investigate conscious use of natural language. In subsequent articles (Henser 2000b, 2001) Henser reports additional empirical work designed to ascertain whether bilingual language-specific thought extended beyond the conscious use of inner speech to encompass a wider ranger of propositional-type thought, including non-conscious thought. Henser gave Japanese-English/English-Japanese bilingual subjects tasks to stimulate silent propositional-type thought and then interrupted them at various points in the preparation for, or the execution of these tasks and tested subjects for language-specific semantic network activation. The results were suggestive in terms of the TNL thesis and extend the conclusions formed from the survey to include non-conscious propositional thought.

In this experiment Henser's object was to create a situation calling for subjects to engage in propositional thought and in which subjects' level of language-specific semantic network (lingpack) activation could be measured. A group of 10 bilingual subjects (5 Japanese-English and 5 English-Japanese) were given the task of preparing

a short talk for delivery to a Japanese audience on a named theme and then interrupted their work at various points in order to give them a Japanese word association test, the conditions being controlled so as to vary the amount of priming or blocking of Ss' Japanese semantic network.

Psycholinguistic studies of aspects of the organisation of a bilingual's languages in his/her brain have made use of word association tests and semantic priming (see Davis and Wertheimer, 1967; Keatley and de Gelter, 1992; Tzelgov and Eben-Ezra, 1992), both of which experimental methodologies are based on a postulated underlying phenomenon of "automatic spreading activation" within semantic memory propounded by Collins and Loftus (1975, see also Posner and Snyder [1975]). The idea here is that, in word association tests, hearing a word like *cat* will activate other nearby nodes on the same semantic network such as *dog* or *mouse*, and will facilitate the recall of these words.

In this experiment, in some conditions the semantic priming was induced overtly (by having subjects engage in Japanese speech prior to the word association test), in other conditions the priming was induced covertly (by having subjects silently think about their talk subject without actually speaking and interrupting them *before* they began their talk out loud). In still further conditions, subjects' Japanese semantic networks were blocked by giving them an English language talk to prepare before the word association test. In each case, in both priming and blocking conditions, abstract words/phrases were used in both the talk theme assignments and the stimuli used in the word association test to ascertain the level of subjects' semantic network activation. By using non-concrete/abstract, and hence not readily imageable words, an effort was made to stimulate subjects' use of their propositional (as opposed to visuo-spatial or other) representational system.

The principle finding of this experiment was the fact that both overt and covert priming significantly, and by roughly the same amount, increased the number of Japanese word associates given by subjects. In other words subjects showed evidence of covert, language-specific semantic network activation. On the other hand, subjects in the blocking condition, where subjects had to prepare a talk in English, gave

significantly fewer word associates. In the statistical analyses, As predicted by the experimental hypothesis, there was no significant difference between the number of word associates produced in the covert priming condition (condition two) and the mean of the two overt priming conditions, *viz.* conditions three and four ($t = 0.873$, $df = 9$, not significant at $p<0.1$ in the t-Test; $W = 19.5$, $N = 9$, not significant at $p<0.1$ in the Wilcoxon Signed Ranks Test).

Where, then, does all this lead us in regards to those questions raised by Ervin-Tripp? What are the implications for linguistic relativity? Also, what direction should future research take?

7. Implications of TNL and future research

Returning to the question raised in the title of this article: What *have* we learned about language-specific thought since Ervin-Tripp's psychological tests of Japanese-English bilinguals way back in the mid-1960s? In short, we have learned rather a lot. As you will recall, Ervin-Tripp's experiments revealed the fact that bilinguals have two separate sets of semantic networks. Also, when shown TAT pictures and quizzed about their meanings in different languages on different occasions, the very same individual would exhibit different characteristics according to the language of discourse. Ervin-Tripp was, therefore, convinced that bilinguals could be accurately conceived of as possessing two separate mind-sets. She also strongly suggested that this was due to their experience with two natural languages, but left it to future researchers to provide a more authoritative answer as to whether language was responsible for bringing about this state of affairs. So then, what can we now add to Ervin-Tripp's findings? To recap, then, we have seen evidence for the concept of thinking in natural language from:

Soholov's studies comparing muscle activity in the vocal tract with localised brain activity during controlled tasks

McGuire et al's PET-scan studies

Spelke's dual-task spatial orientation studies which showed that natural language is used in cognition to facilitate the synthesis of data from diverse knowledge-representation modules and, thus, language qualitatively enhances cognition by permitting a degree of flexibility in information processing that would otherwise not be possible.

Henser's work with bilingual self-reports of awareness of language-specific inner speech and experimental substantiation in the form of language-specific semantic network activation during propositional thought.

By way of conclusion, we can say that the case for natural language being the format for propositional knowledge representation is getting progressively stronger and stronger. This means that we are getting nearer to drawing the conclusion that humans do much of their thinking in natural language that, at the very least, our propositional thoughts are in natural language format. Propositional thought does not, therefore, take place in an amorphous, universal non-natural language format, but in the specific natural languages that we speak. This also carries with it the corollary that bilinguals engage in language-specific thought - sometimes in one of their languages, sometimes in the other.

It follows that, if much of our propositional-type though takes place in a natural-language-specific format, then an influence on thinking - both developmental and ongoing - is to be expected. Therefore, in strengthening the case for TNL (the Thinking in Natural Language Thesis), we are also coming nearer to providing a mechanism for linguistic relativity, a way of explaining why it is that speakers of Tzeltal, for example, don't attend to details of egocentric spatial location or use these details in problem solving.

As to future research, better control conditions, larger population samples and heteromethodology will lend further weight to the present findings. Also research with language-specific thought in other modalities e.g. Sign-base deaf thought, including the use of internalized Sign in unconscious creative activity, will enrich this avenue of research. Additionally, following Spelke's suggestions, the dual-task method can be usefully employed in other modalities to further test the finding that

natural language is deployed in synthesizing data from different knowledge representation modules.

The future for research is therefore most promising. It is a future in which natural language, and the language/thought relationship is due to occupy the centre-stage position it deserves in scientific psychology and its related disciplines.

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Glossary of Key Terms/People

Keyword/Person	Comments
Susan Ervin-Tripp (1927-)	Psychologist/Psycholinguist. Prof. Emeritus University of California, Berkeley 1999-. Ervin-Tripp, along with Chomsky, Osgood and others, was one of the pioneers of modern psycholinguistics. She conducted a series of experiments with Japanese-English bilinguals.
T. A. T.	The Thematic Apperception Test. A test used in psychology, developed by Henry A. Murray and his co-workers. Subjects are shown black-and-white drawings which admit various possible interpretations and are asked to tell a story about each. The stories are analysed in terms of the thema which the subject introduces into each narrative.
semantic network model of human long-term memory	A theoretical model of the structure of human long-term memory. The model assumes that information is represented in discrete, independent units which are interconnected by links or relations. For example, cat is assumed to be represented by links such as 'has fur', 'is domestic', 'is a mammal', etc. The network formed by the central node and all of its associated links represents the memory of the concept cat.
semantic links	Links between units of meaning that speakers of the same language might, by dint of shared public definitions of words, be expected to hold in common. E.g. the links between chair and seat (synonym), or top and bottom (antonym).
affective/ connotative links	Links between units of meaning formed as a result of personal experiences, which vary from individual to individual. E.g in the case of a person who had been bitten by a dog at a very impressionable age, dog might be linked to savage or fear.
Linguistic Relativity	The theory that specific languages influence the way their speakers think and categorise experience.

Keyword/Person	Comments
Benjamin Lee Whorf (1897-1941)	American linguist and prominent exponent of the linguistic relativity theory - also called the Sapir-Whorf Hypothesis after Whorf and his fellow linguist and mentor Edward Sapir (1884-1939), although the tradition of which this idea forms a part antedates those scholars and includes the works of Wilhelm von Humboldt (1762-1835) and the German American anthropologist Franz Boas (1858-1942). Whorf did most of his research among the American Indian peoples, especially the Hopi Indians. Despite the prejudices of those of his generation, Whorf was a great egalitarian who positively evaluated the American Indian culture. He also held that their languages were in some ways better suited to the task of accurately representing physical reality than English was.
Jerry Fodor (1935-)	Philosophy of Psychology, Philosophy of Mind/Language, Rutgers University (Professor), N.J. Principal spokesman for the Mentalese (non-natural language-specific knowledge representation format) version of the LOT (Language of Thought) Hypothesis within the Philosophy of Language/ Philosophy of Mind discipline.
Peter Carruthers	Philosophy of Psychology, Philosophy of Mind/Language Sheffield University (Professor), Director of the interdisciplinary Hang Seng Centre for Cognitive Studies also at Sheffield University, UK. Principal British exponent of the idea of natural language-based propositional thought.
propositional knowledge representation	Modern psychology and its related disciplines envisage a number of different systems of mental representation of knowledge, including the visuo-spatial system, propositional system and kinaesthetic systems. The propositional representation system might be conceived of as the system where more abstract data is stored. For example, it's easy to store a visual image of a sphere or a cube, but how does one store a visual image of honesty or democracy?
TNL	The Thinking in Natural Language thesis. The idea that many, or most of our propositional thoughts are in natural language.

Keyword/Person	Comments
Mentalese	A postulated innate, universal non-natural language-specific knowledge representation format. Advocated by Jerry Fodor, Steven Pinker etc.
Soholov	Russian psychologist. Soholov, along with other Soviet psychologists, did follow-up work based on Vygotsky's observations on the rôle of inner speech. Soholov, in particular, used the electromyograph and the electroencephalograph to investigate the state of subjects' speech organs and brain electrical activity during thinking.
electromyograph	An instrument used (especially in phonetics) to observe and record muscular contractions during speech. Electromyography involves the application of electrodes to the muscles involved in the vocal tract, and the analysis of the electromyographic traces produced visually.
electroencephalograph (EEG)	An instrument which uses electrodes placed on the surface of the scalp to record continuous cortical electrical activity - in particular, the amount of 'alpha' rhythm in the brain waves, which is reduced when an area of the brain is in active use.
aphasia	A handicap of language comprehension and/or production caused by specific brain damage.
positron emission tomography (PET)	A procedure that provides an analysis of the amount of metabolic activity taking place in various parts of the brain. A PET-scan patient/subject is injected with a radioactive glucose-like substance that is absorbed into their cells, particularly those that are metabolically active. The individual's brain is then scanned in a manner similar to a CAT (computerised axial tomography) scan.
Elizabeth Spelke	Professor of Psychology, Department of Brain and Cognitive Science, MIT (Massachusetts Institute of Technology). Researcher in the field of developmental psychology. Demonstrated a key rôle for natural language in synthesizing data from various modalities, thus enabling the kind of flexibility in thinking that sets adult humans apart from pre-linguistic infants and animals.

Keyword/Person	Comments
module	A hypothesised, relatively circumscribed cognitive or perceptual faculty. This term, with the above meaning, was first introduced by philosophy Jerry Fodor (of Mentalese/LOT fame), but has been adopted by many psychology researchers, and is similar in meaning to the old expression faculty (as in Faculty Psychology). Modules are hypothesised as being informationally encapsulated, peripheral (as opposed to global mechanisms like Central Cognition), fast and involuntary/automatic. In Fodor's philosophy of mind, natural language is relegated to the position of an input/output peripheral transducer module.
public language/ private language	A distinction drawn by Fodor and others between their postulated Mentalese or LOT (language of thought), which is used for thinking and is unlearned, innate (the private language), and natural language (public language), which is used for communication with others, is learned, and the possession of which does not qualitatively enhance the cognitive abilities of its speakers, since these speakers are already born with ability to use their innately endowed private language.
automatic spreading activation	A phenomenon within semantic memory propounded by Collins and Loftus (1975). The idea is that, in word association tests, hearing a word like cat will activate other nearby nodes on the same semantic network such as dog or mouse, and will facilitate the recall of these words.