

## Retroactive or proactive control of the bilingual system

ANNETTE M. B. DE GROOT

Department of Psychology, University of Amsterdam, Roetersstraat 15, 1018 WB Amsterdam, The Netherlands.

E-mail: pn\_groot@macmail.psy.uva.nl

The schema concept has had a long and varied history in psychology. It was introduced by Bartlett (1932), who observed that subjects' reproductions of a story showed systematic deviations from the original. Elements in the original story that were uncommon or strange were lost or changed and elaborated such that they became more common and made more sense to the subjects, and infrequent words and concepts were replaced by more common ones. Bartlett explained this normalization behavior by assuming that humans adapt incoming information to existing knowledge structures in long-term memory and that they understand new information in terms of these structures. These knowledge structures were called schemas. Schemas may represent our knowledge of stereotypical events such as doing the laundry or cooking a meal (these schema structures are usually called scripts, Schank & Abelson, 1977), of objects and natural categories (see Anderson, 1985, for a discussion), and the knowledge underlying routine behavior (Norman, 1981). They provide a basis for explaining many different phenomena of information processing and memory functioning, such as inferring, elaborating, stereotyping, reconstruction, false memorization, and the occurrence of slips in task performance. When, for instance, a reader encounters the word *forest* in a text, he is not surprised to see the noun phrase *the trees*, with the definite article, in the next sentence even though no trees were explicitly introduced before. The reason is that the word *forest* activates the relevant memory structure, the *forest* schema, and from that moment all the information contained by this structure, including the knowledge that forests are made up of trees, is available for processing.

More recently the term "schema" (or script) has not only been used to refer to permanent structures in memory, but also to memory structures that are created on the spot from higher-level structures while performing a particular task. For example, no dentist script exists in memory as one precompiled chunk, but this script is dynamically constructed from other memory units the moment it is needed (Schank, 1985). This same idea features in the work of Barsalou (e.g., Barsalou, 1987), who poses the view that concepts are not retrieved as wholes from memory but constructed in working memory on the spot, the precise information incorporated in the concept depending upon the particulars of the context and recent experiences. A central component of Green's present model of language control in bilinguals is reminiscent of this view of schemas as structures that are built in working memory when performing a particular task, but it seems to differ from it as well. Whereas the more common view of schema construction is that previously present elements in memory are assembled into the schema, many if not all of the building

blocks of Green's "language task schemas" seem to be provided by the instructions presented to the subjects prior to the experiment. The task schemas appear to be the equivalent of an understanding of the task instructions in the subjects, of their mental representation of these instructions. By referring to them as schemas, the already extremely wide use of this term (too wide, according to many) is broadened even more. And in this expanded use of the term, the core of the original notion of a schema – pre-existing knowledge that is accessed and used during the understanding process (but that is not equivalent to the end-product of the understanding process itself) – seems to be lost. Of course, an understanding of the task's goals (whether correct or incorrect) underlies all task performance, whatever the performance model. What then is the unique feature of Green's model of bilingual language control?

Unique in Green's model seems to be the assumption that the language task schemas, constructed and controlled by the "supervisory attentional system", operate retroactively rather than proactively upon the level of activation of the units in the bilingual lexico-semantic system proper. For instance, if the subjects' task is to translate L1 words into L2, activated L1 lemmas must be inhibited if their names are not to pop out inadvertently as responses. The task schema dominant under the prevailing circumstances, the L2 production schema, takes care of this by reactively suppressing the level of activation of the lemmas with an L1 language tag and enhancing the level of activation of the lemmas with an L2 tag. If, on the other hand, the subjects must name pictures in L1, an L1 production schema must, again reactively, suppress the elements with an L2 language tag and enhance those with an L1 tag.

Green's model thus shares with other models the notion that control is effectuated by relative changes in the activation levels of sets of elements in the bilingual's lexico-semantic system. The elements of the output language must be activated more than those of the other language. A difference, however, is that these other models typically assume, albeit often only implicitly, that an understanding of the task goal is translated proactively into specific levels of activation of the relevant L1 and L2 elements. For instance, a bilingual may adapt to the task of naming pictures in L1 by boosting the activation level of the L1 elements and suppressing the activation of the L2 elements as much as possible, preferably to zero. She may do so immediately upon receiving the task instructions, and prior to the presentation of the first stimulus. When instead her task is to name pictures in L2, the opposite state of affairs is effectuated. And when L1 words have to be translated in L2, she may adapt to this task by setting the activation level of the L1 units clearly above zero, but lower than the

activation level of the L2 elements. Both languages must be activated to some extent because translation involves both of them, but the output language should be activated more than the input language because language production requires a higher level of activation than does language comprehension (Paradis, 1994). In the Bilingual Interactive Activation (BIA) model developed by Grainger and Dijkstra (1992), an understanding of the task goal may be translated into a change in the relative levels of activation of the two language nodes in the bilingual system, which in turn would affect the relative levels of activation of the L1 and L2 word nodes in a second layer in the system. In Poulisse and Bongaert's adaptation of Levelt's language production model to the bilingual case (see Poulisse, 1997), the goal to produce one language and not the other is reached by installing a language cue as one of the conceptual features in the conceptual representation. As in Green's model, a language cue is attached to each lemma. What lemma will be selected for output (because activated most) is determined by the degree of overlap between the information specified in the lemma and the set of activated conceptual features that includes the language cue. This set-up guarantees that most of the time the lemma of the contextually appropriate language will be activated more than the corresponding lemma of the contextually inappropriate language (whose language cue mismatches with the language cue in the conceptual representation). As a consequence the former lemma is the one eventually assigned a phonological form and output in that form. The presently important common point of the BIA model, Poulisse and Bongaert's model, and indeed most models that can account for language control one way or the other, is that according to them the activation levels of the relevant L1 and L2 memory nodes are proactively adapted to the task.

Proactive task adaptation seems more efficient than the retroactive regulation, by language task schemas, of the output of the bilingual lexico-semantic system suggested by Green. When the activation levels of the memory nodes in the bilingual system are proactively adapted to the specific goal of the subjects (that is, prior to the onset of task performance), the representational elements that belong to the contextually inappropriate language may generally not be activated enough to become available in the first place, and no mental energy will thus have to be wasted to prevent them from being produced as output. In contrast, in a retroactive system both the contextually appropriate

and the contextually inappropriate memory nodes will often be available, requiring active suppression of the latter, a process that is likely to consume mental energy. Before we trade a model that assumes efficient processing for one that assumes more laborious processing, we should know exactly what it is that forces us to do so. The pertinent question to be answered then is why we would need the present concept of language task schemas at all, including its assumptions about the locus of control in the bilingual system. I found myself unable to answer this question. Presumably the presently stretched notion of a schema – a notion that is hard to distinguish from a mental representation of the instructions or from a set goal – is to a large extent responsible for my failure to embrace the proposed model without reservations. But whatever the ultimate answer, Green's present contribution is important as it is. It fosters the awareness that models of bilingual processing are incomplete if they do not specify the mechanisms that support bilingual control.

### References

- Anderson, J. R. (1985). *Cognitive psychology and its implications* (2nd edn.). New York: Freeman and Company.
- Barsalou, L. (1987). The instability of graded structure: Implications for the nature of concepts. In U. Neisser (ed.), *Concepts and conceptual development: Ecological and intellectual factors in categorization*, pp. 101–140. Cambridge: Cambridge University Press.
- Bartlett, F. C. (1932). *Remembering*. Cambridge: Cambridge University Press.
- Grainger, J., & Dijkstra, T. (1992). On the representation and use of language information in bilinguals. In R. J. Harris (ed.), *Cognitive processing in bilinguals*, pp. 207–220. Amsterdam: North Holland.
- Norman, D. A. (1981). Categorisation of action slips. *Psychological Review*, 88, 1–15.
- Paradis, M. (1994). Toward a neurolinguistic theory of simultaneous translation: The framework. *International Journal of Psycholinguistics*, 10, 319–335.
- Poulisse, N. (1997). Language production in bilinguals. In A. M. B. de Groot & J. F. Kroll (eds.), *Tutorials in bilingualism: Psycholinguistic perspectives*, pp. 201–224. Mahwah, NJ: Lawrence Erlbaum.
- Schank, R. C. (1985). Reminding and memory organization. In A. M. Aitkenhead & J. M. Slack (eds.), *Issues in cognitive modeling*, pp. 229–249. Hillsdale, NJ: Lawrence Erlbaum.
- Schank, R. C., & Abelson, R. (1977). *Scripts, plans, goals, and understanding*. Hillsdale, NJ: Lawrence Erlbaum.