Different Problems Require Different Solutions.
Various Proposals for Specific 'Tip-of-the-Tongue'-Problems

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Language production is a cyclic process involving a loosely ordered set of tasks: ideation, formulation, articulation. This sequence holds not only for sentence production, but also for the synthesis of words that have conceptual (meaning), linguistic (lemma) and grapho-phonological (physical form) components.

It is a truism to say that words are important as they play a fundamental role in speaking, reading and writing, and probably even in thinking. While readers are mostly concerned with *meanings*, writers are generally more concerned with their expressive *forms* (lemmata). I will focus here on their access via an external resource. More precisely, I am interested in building a tool to help writers to overcome the **T**ip-**o**f-the-**T**ongue problem (ToT), a state where authors know a word, but for some reason are momentarily unable to access (fully) its phonological form.

ToT states can be caused by many factors: lack of practice/attention, interference due to the proximity/similarity of competing elements, etc. Also, ToT problems manifest themselves in various forms: silence, gaps, or errors having taken place at various levels. Given this diversity of problems, we need to build specific tools in order to address each one of them. What kind of tool to build, and how to use it will crucially depend on the *nature* of the *problem* (choice of wrong lemma, speech sound error), and the *types* of *knowledge* available at the onset of the search, the author knowing (part of) the meaning, some of the syllables of the target, or a somehow related word (encyclopedic knowledge, co-occurrences, associations).

Since the yet-to-be-built tool is meant for people I will start from them, that is, their habits, knowledge and needs. Obviously, in order to be useful, a tool must allow to achieve the goal for which it has been built, in our case, word finding. Yet, in order to get into a position allowing us to define good design criteria (objectives), we need to find out more about the user. For example, we need to understand

- how words are represented, stored and organized in the brain, i.e., the mental lexicon;
- the way how humans synthesize words;
- the specificities of the process where humans search deliberately a word in a dictionary (book) or its electronic counterpart (navigation);
- the reasons of success and failure in on- and off-line processing;
- the various kinds of knowledge a user has when launching the search.

Since all of this information is relevant and useful for solving the problem at hand, it should be taken into account by the resource builder (computational lexicographer). To be a bit more concrete, let us consider the following facts:

- Empirical data (brains scans) clearly show that *meanings* and *forms* are distributed across various layers in the human brain. This contrasts sharply with most peoples' understanding of words and their representation in dictionaries. While the *signifier* and the *signified* do appear next to each other in this kind of resource (holistic representation), they are dissociated in the mental lexicon. This challenges the belief that word access is direct, meanings yielding (automatically) their corresponding forms. In reality, words are synthesized over time. The speaker goes through various states (ideation, formulation, articulation) which all take time. Clearly, words in books, computers or the human brain, simply are not quite the same.
- The analysis of *speech errors* supports the same conclusion: words are decomposed, their meaning and forms being processed at different stages. 'Hysterical' and 'historical' have nothing in common from a semantic point of view, nevertheless, from a phonological point of view they are neighbors. This kind of error as well as the following —turn 'left', sorry, turn 'right'— lend support to the

conclusion that words are organized *relationally* (synonyms, hyperonyms, antonyms) rather than *alphabetically*. While 'left' and 'right' are at quite some distance in an alphabetically organized lexicon, they are direct neighbors in the mental lexicon. This is why we tend to confuse them, saying one, while meaning the other, eventhough they express exactly the opposite.

- Studies regarding the *tip of the tongue problem* teach us that people always know something concerning the target word —meaning, form (rhyme, syllable), related word (co-occurrence, association)— even if they fail to fully activate its phonological form.

While all this is relevant with respect to word access, this is not enough, as we deal here with deliberate search (navigation), i.e., word access via an external resource (mediated lexical access). There may be imperfections on either side (human or the machine). Yet, to allow for a successful dialogue between the two, we need to take their respective knowledge into account. Obviously, the resource must contain the item we are looking for. Yet this is not sufficient. Access may depend on other factors than the storage of word forms, such as the organization of the data (index); the user's cognitive state, i.e., available knowledge at the onset of the search; the network's topology; the distance between the source- and the target word (direct or indirect neighbor); the knowledge of the relationship between the two, and so on. Put differently, next to *factual knowledge* (storage of word forms), we need to take *metaknowledge* and *cognitive states* into account.

Metaknowledge refers here to the knowledge a user has concerning the organization of the lexicon. For example, the position of a word within the network, the relative distance between two words, and the type of relationship holding between a query (input) and the target word. All this topological information is useful to determine the quality of a query term. For example, it is not a coincidence that search is typically initiated with a close neighbor of the target word.

That human beings possess and make use of metaknowledge can easily be demonstrated. Why would anyone take the pain to create resources like dictionaries, thesauri (topically organized lexicon), or encyclopedias if they did not correspond to specific needs? Also, quite a few people use them, choosing the one they believe fits best their needs. Hence, depending on what they know or would like to know they will reach for a thesaurus, a specific kind of dictionary (ordinary, bilingual, synonym, collocation), a lexical resource (WordNet, BabelNet), or an encyclopedia (Wikipedia, the web).

Finally, we need to consider *cognitive states* (CS). They are the kind of information we draw upon when looking for a word. CS are momentarily available information, like the word(s) coming to our mind when we are looking for a form we know, but cannot access (ToT state). CS are generally multifarious, containing various sorts of information (conceptual, linguistic). Given their dynamism — CS vary from person to person and from moment to moment— they are hard, if not impossible, to predict. Yet, they do exist, people are even aware of them, accommodating their search strategies accordingly, by emphasizing the search in line with the information momentarily available to them (meaning, sound or target-related words).

Obviously, CS present a huge challenge for the knowledge engineer, in particular if we expect him (as I do) to build a resource powerful and flexible enough to accommodate to all these situations, despite their constant changes and unpredictability. To achieve this goal he will probably consider different corpora, depending on the information he is looking for: *meanings* or meaning fragments (use definitions), *syllables* (any textual resource), *collocations* and *associations* (use encyclopedia, or texts containing 'episodic' knowledge, for example, news reports).

These are some of the factors to be taken into account when building a tool meant to help people to find the word that they are looking for. During my talk I will present some empirical work, several search scenarios and my proposals of how to overcome the ToT problem in each case. While I cannot offer yet the resource(s) I have in mind —so far this is only a concept, roadmap, or pen and paper simulation existing mainly in my mind— I hope to be able to convince the audience of the soundness of the approach. Needless to say, that the ultimate test is a real-world situation where authors lost for a word are able to overcome the ToT problem due to the usage of the here described resource(s). Obviously, the resource still needs to be built. If you are interested in doing so, please let me know.