

## The Switch

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### Questions:

What is the nature of the switch? When does it operate?

How much time is required? How selective is it?

How much control does it have? Can it be tricked?

Does its ability depend on the level of L2 vs. L1?

Is it language-specific?

Where is its neuroanatomical location? What kinds of deficits are associated with damage to this area?

Is there a better metaphor?

## Language Selection in Bilinguals: Meuter (2005)

- If speaking in the dominant language is easier, is it also easier to switch back when using the weaker language?
- Mostly a consensus regarding a common storage between L1 & L2, especially for linguistically-adjacent languages (phono., ortho.)
- Switching/control is not totally volitional (intrusions) but errors are infrequent
- Experimentally forcing subjects to switch can induce response latencies which inferentially could mean that some cognitive preparation is required for the speaker to handle input & report output in another language

## Author's Big Questions

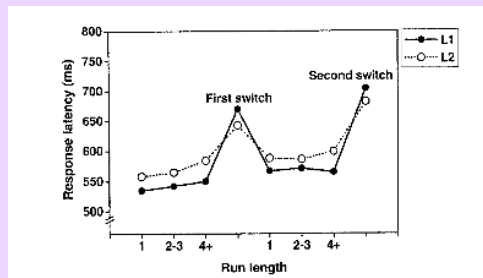
- How is interference prevented? How is a language de-selected? To what extent does the inhibition/deselection occur?
- What role does proficiency play in the deselection? Will this affect RT?
- Which factors/cues trigger the switch? How reliable are they?
- How is the switch maintained? When does the deselected language intrude?

## Selection & Deselection

- Comparisons (numerous) between the time required to read a mixed vs. a monolingual passage; the former takes longer to read and comprehend (200-500 ms cost at each switch?); hesitation at each switch
- Early research assumed clear separation of the languages, a conditioned signal flips the switch (Penfeld & Roberts, 1959)
- Cost probably is not identical in both directions (specific transitions not studied)
- More difficult production in L2 could be influenced by need to suppress dominant L1 information; easier to suppress L2 when speaking L1 - so is it easier to switch to L1 from L2? (Macnamara, 1967)

## Global vs. Local Inhibition

- Alternative language choices are not well suppressed in lexical decisions; both/all initially active, then task relevant option selected (while others are inhibited?) The case for spoken and written language
- Green's Inhibitory Control model (IC) (1993, 1997, 1998): lemmas are tagged for language-specific info, then tags are activated or inhibited by language task schemas (control language actions; can be automatic; winning schema determined via contention scheduling?)
- Also supposes that language as a whole (ie, global) will be affected by the schemas - but they can be selective (eg, easier to inhibit translation equivalents than...word for word translation?)



- Author's own demonstration of longer switch costs associated with L1; generally responses faster in more proficient L1; present in numeral naming, conversation, picture-word interference
- Why? Language set (schema?) established, with attendant inertia (takes more effort to suppress dominant language and therefore more effort to undo suppression)

## Global vs. Local Inhibition, cont.

- But does this massive suppression occur over all/multiple/few language domains? Unclear, authors state that since responses return to normal rate on the trial after the switch was made that the whole system must have been suppressed initially, then it can experience total liberation
- Studies purported to demonstrate local inhibition unclear (Can someone explain these?)

## Role of Proficiency in Selection

- Does it logically follow that a more balanced bilingual will have more balanced switch costs? Authors find support in superordinate naming task, no asymmetry in switch costs for French-English, or in Stroop
- Increased proficiency increases reliance on same language stores, as shown with neuroimaging
- For late bilinguals during story comp., separate activation in left temporal for L1 and left inferior frontal gyrus & anterior cingulate in L2 (Dehaene et al., 1997)
- For more balanced (early) bilinguals, greater overlap in cortical areas during auditory comprehension, bilateral activation

## Cueing of Language Choice

- When items in one language more closely resemble items in the other, likelihood for co-activation/interference is increased
- To decrease switch costs, external non-linguistic cues (colors, shapes) can help speaker prepare; regular, predictable alternations can help or even eliminate switch costs
- Suppression, however, can increase switch costs, more so than an actual switch, suggesting a more global inhibition?

## Language Maintenance

- Monitor input for relevant language; unexpected input incomprehensible
- Best data gleaned from brain-damaged patients (speech errors too few in healthy subjects); frontal lobe damage the culprit
- Task-switching in general depends on frontal lobe integrity, and damage results in perseverative (ie, failure to switch tasks) errors; more specifically left frontal lobe damage
- Language-specific cueing can still result in inappropriate and uncontrollable errors in brain-damaged patients; other results unpredictable
- In normals, increased activity in DLPFC during switch in a picture-naming task

## Costs in Bilingual Visual Word Recognition (Thomas & Allport, 200)

- Does one lexicon need to be disabled when the other is in use?
- Separate for comprehension and production (more control in latter)
- For comprehension, smaller switch costs in ID when orthography is more language-specific (more unique to one language) (Grainger & Beauvillain, 1967)
- When there is overlap in orthog. between languages on a switch trial, processing is less efficient since the complete switch to the language-specific schema is slowed, previous language's schema still active
- Authors think earlier studies were incomplete and that language-specific orthography cannot always eliminate switch costs, need to see how the non-words are perceived when they are only pronounceable in one language; perhaps not demonstrating lexical access but only knowledge of orthography; need to create problems between languages with non-words

## Experiment 1

- 2 (English/French) x 2 (word/non-word) x 2 (nonspecific/specific orthog.)
- 8 sets of 32 words comprised of above design
- Words were thoroughly analyzed for 'wordness' in both languages as well as 'nonwordness'; accents removed
- Native English speakers used with varying degrees of French experience
- Faster to English words, to words vs. nonwords, to lang.-specific vs. nonspecific (though not more accurate); faster to reject English-specific nonwords than nonspecific nonwords, but not the same for French (more influenced by orthography, less by lexicality in French)
- No switch costs for nonwords (same speed regardless of specificity of orthography); language had no effect on switch costs

## Thoughts

- Should there be two schemas (one needing to be inhibit) during a language-specific task? Or should there be only one schema relevant to the task without the need to inhibit (and engender switch costs)?
- Not two languages, but two intrinsically-conflicting tasks, one needing to be inhibited (as shown when there are switch costs when the language is being held constant); task directs to one language vs. another
- How is this NOT language specific? Task schema predictions include no differences in switch costs between language-specific and non-specific items; should see more of a cost when switching between words and pseudowords vs. between languages (more of a task cost)

## Experiment 2

- Told to do word/nonword task within context of one language at a time, including judging specific and nonspecific orthog. from other language
- Used some native French speakers (different groups)
- Nonwords slower than words, wrong context words slower than nonwords (but no difference in switch costs); smaller switch costs for language-specific words vs. nonspecific is a task, not language, schema effect; on switch trials, illegal nonwords (in previous context) had slower RTs (task inertia); slowest were nonwords specific to current language (but unaffected by switch); remember, with comparison to baseline
- All pointing towards evidence for task schemas?

## Experiment 3

- Interlingual homographs used (same spelling, different meaning, different frequency)
- Same participants as Ex. 2
- Increased switch costs for bilingual homographs, more so than interlingual homographs; cognate homographs (same spelling, same meaning) showed cost in accuracy at switch but not RT
- Tasks compete but also within-lexicon effects do damage; errors are failures to inhibit previous task demands

## More Thoughts

- Language vs. Task: One and the same? Are all linguistic intrusions being controlled? Better way(s) to disentangle?
- Since languages share common base, costs are labored efforts to focus on task-relevant procedures; maybe different selection for visual vs. auditory stimuli (visual more likely to elicit data from two languages if not in context)
- Inhibition not on lexicon but on old task demands? Like brain-damaged patients?

## Picture Naming with fMRI: Hernandez, Martinez & Kohnert (2000)

- Overlapping vs discrete cortical representations during switching?
- Probably not: general executive attentional system outside language
- Initial confusion: some patients don't recover both languages; in some instances recover weaker language, ergo separate language stores
- Depending on proficiency, language areas overlap or appear more discrete
- Same for control mechanisms? One pattern of activity designating maintenance?
- Candidates: supramarginal gyrus, posterior sylvian fissure, parietal areas (no consensus from earlier work)

## More specific search?

- Probe frontal lobe areas known to be responsible to task switching
- Using cues (say, *diga*), elicit switching in Spanish-English bilinguals and look at DLPFC and the supramarginal gyrus
- Typical switch costs observed, increased activity during switching for left DLPFC for all (right for 4/6), half for left supramarginal gyrus
- Significant only for DLPFC, probably not language-specific switch, though state of technology is not sophisticated enough to examine even more fine-grained activation with better temporal resolution