



## STEREO-TYPING: HOW THE QWERTY KEYBOARD SHAPES THE MENTAL LEXICON

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Does motor experience shape word meanings? Motor fluency is linked to emotional valence: people tend to like things that are easy for them to interact with physically (Oppenheimer, 2008).

Fluency-valence associations may have surprisingly pervasive effects. Right-handers, who act more fluently with their right hand than with their left, associate positive ideas like goodness and truth with rightward space, and negative ideas with leftward space (Casasanto, 2009). Asymmetries in manual motor fluency shape people's mental representations, even in highly abstract domains that seem far-removed from motor experience.

Increasingly, the hands provide a medium for producing language, as English speakers spend countless hours communicating via text documents, email, Internet chat, blogs, and social networking sites. The QWERTY keyboard mediates this communication for millions of language users. Some words are spelled with letters on the left side of the keyboard (e.g., bastard, waste), and other words with letters on the right side (e.g., jolly, lollipop).

Could experience with QWERTY be shaping the mental lexicon? That is, are right-handers (a 90% majority) shifting the positivity and negativity of words meanings through implicit hand-valence associations? If so, words with more right-hand letters should have more positive meanings on average than words with more left-hand letters.

To test this proposal, in Experiment 1 we analyzed the relationship between valence and QWERTY key position in the 1034 words of the Affective Norms for English Words (ANEW) corpus (Bradley & Lang, 1999). We computed the difference between the number of right-hand and left-hand letters in each word (Right-Hand Advantage=(#right-hand letters)-(#left-hand letters)), and correlated these scores with the words' valence. As predicted, the Right-Hand Advantage was positively correlated with ANEW valence ratings ( $r=.06$ ,  $p=.04$ ). ANEW ratings were collected using pencil and paper, ruling out online effects of typing fluency.

Since most of the words in ANEW existed before the invention of QWERTY, it is possible that the effects in Experiment 1 were due in part to word frequency or pre-existing semantics.

To examine effects of key position independent of pre-existing semantics and frequency, in Experiment 2 we asked English speakers ( $N=800$ ) to rate the valence of 1600 pronounceable nonce words (20 items per participant), presented as words in an alien language. We used a computerized version of the ANEW rating scale, which required participants to click on radio buttons, but not to type.

Nonce words containing only right-hand letters were judged to be more positive than those containing only left-hand letters ( $t(174)=2.00$ ,  $p=.02$ ). Across all 1600 nonce words, the Right-Hand Advantage correlated positively with valence ratings ( $r=.08$ ,  $p=.001$ ), even when word length was controlled ( $r=.06$ ,  $p=.01$ ). Implicit associations between typing fluency and valence may be stored at the level of the letter or group of letters.

The link between QWERTY key position and valence is evident even for novel words, and even when people are not typing. It appears that the meanings of English words have been shaped by right-handers' interactions with the QWERTY keyboard.

Casasanto, D. (2009). Embodiment of Abstract Concepts: Good and bad in right- and left-handers. *Journal of Experimental Psychology: General*, 138(3), 351-367.

Oppenheimer, D. M. (2008). The secret life of fluency. *Trends in Cognitive Science*, 12(6), 237-241.