



The automaticity of emotional Stroop: A meta-analysis

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Abstract

An automatic bias to threat is often invoked to account for colour-naming interference in emotional Stroop. Recent findings by McKenna and Sharma [(2004). Reversing the emotional Stroop effect reveals that it is not what it seems: The role of fast and slow components. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 30, 382–392], however, cast doubt on the fast and non-conscious nature of emotional Stroop. Interference by threat words only occurred with colour naming in the trial subsequent to the threat trial (i.e., a “slow” effect), but not immediately (i.e., a “fast” effect, as would be predicted by the bias hypothesis). In a meta-analysis of 70 published emotional Stroop studies the largest effects occurred when presentation of threat words was blocked, suggesting a strong contribution by slow interference. We did not find evidence; moreover, for interference in suboptimal (less conscious) presentation conditions and the only significant effects were observed in optimal (fully conscious) conditions with high-anxious non-clinical participants and patients. The emotional Stroop effect seems to rely more on a slow disengagement process than on a fast, automatic, bias.

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1. The automaticity of emotional Stroop: a meta-analysis

Emotion deals with things that are important and should, therefore, receive information processing priority (Compton, 2003). It is plausible that some emotional stimuli are picked up very quickly and set up the system in a particular emotional processing mode (Oatley &

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Johnson-Laird, 1987). Evolution has enabled the brain to shift processing priorities on the basis of stimuli that are not even fully perceived. Particular classes of privileged stimuli, such as several types of vermin, facial expressions, but also blood and mutilations, have signalled emotional relevance throughout evolutionary history. These evolutionary prepared stimuli (e.g., Öhman & Mineka, 2001) may have become engraved in our brains and activate emotional processing modes even at weak strengths or short durations. Evolutionary preparation is probably responsible for the paradoxical finding that affective priming by happy and angry faces gets stronger when presentation becomes weaker and conscious processing is presumably reduced (i.e., stronger-suboptimal-than-optimal affective priming; Murphy & Zajonc, 1993; Rotteveel, de Groot, Geurtskens, & Phaf, 2001).

A stronger-suboptimal-than-optimal pattern has also been claimed for the emotional Stroop task (Fox, 1996). The slowing of colour naming by fear words in high anxious groups is traditionally accounted for by an automatic bias directing attention towards the emotional meaning of the words (Williams, Watts, MacLeod, & Mathews, 1988). In classic Stroop, when naming the colour of the letters of colour words, automaticity of word reading has been inferred from asymmetrical interference effects. Only colour naming is affected by word meaning, but word reading remains impervious to letter colour (but see Durgin, 2000, for a reverse classic Stroop effect). This argument does not hold for emotional Stroop because colours and fear meanings do not lie on the same dimension (see Algom, Chajut, & Lev, 2004). The primary evidence for automaticity with emotional Stroop seems to come from experiments with “subliminal” presentation (i.e., by short presentation and masking to prevent, or at least reduce, conscious perception) of fear words. To avoid the notion of a consciousness threshold (i.e., “limen”), implying an identity position on conscious and non-conscious processing (e.g., see Mandler, 1996), we, however, prefer the terms “suboptimal” and “optimal” above “subliminal” and “supraliminal”. In the automatic bias view, moreover, conscious processing may counteract automatic effects, so that interference by suboptimally presented threat words can even exceed interference in optimal conditions (Fox, 1996; MacLeod & Hagan, 1992; MacLeod & Rutherford, 1992).

Some pictures and sounds may have been evolutionary prepared, but can this also be the case for emotion words? Words from the same emotional category do not share obvious perceptual characteristics. Across different languages, words with the same emotional meaning may look quite differently. In view of the large number of different languages that exist, it is unlikely that particular emotion words share a large part of our species' evolutionary history. Fast neural routes (e.g., LeDoux, 1996) are probably dedicated to processing evolutionary prepared stimuli. Electrophysiological studies, however, suggest that the emotional value of words is encoded relatively later in the brain than of facial expressions (for a review, see Compton, 2003). An evolutionary account for the automatic processing of emotion words, thus, seems implausible.

Automaticity in the emotional Stroop task may also arise through extended practice with emotion words (e.g., Phaf, Christoffels, Waldorp, & den Dulk, 1998) or may be acquired during ontogeny in other ways (see Williams, Mathews, & MacLeod, 1996). For the classic Stroop task, however, the evidence in favour of automatic processing through practice with the colour words is also rather mixed (see MacLeod, 1991), and automaticity even appears to be contradicted by a number of experimental results (Besner, Stolz, & Boutilier, 1997; Durgin, 2000). Williams et al. (1996), moreover, reject the practice hypothesis for the emotional Stroop task because interference appears to decrease after

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