Introduction

Dehaene, Changeux, Naccache, Sackur and Sergent (2006) proposed a taxonomy that distinguishes between subliminal, preconscious and conscious processing, based on bottom-up stimulus strength and top-down attentional amplification. The aim of the present study was to empirically test their taxonomy. Using the priming paradigm and presenting primes and targets at two different places, we manipulated both bottom-up strength (by presenting primes either subliminally or clearly visible) and top-down attentional amplification (by either directing subjects’ attention to or away from the primes using a cue) of the prime stimuli.

Using these two manipulations we empirically recreated Dehaene et al.’s taxonomy and based on their model we can now test in which conditions priming effects are observed.

Method

Subjects

52 volunteers had to categorize numbers as smaller or larger than 5.

Procedure

Participants first received the subliminal condition, where the prime had weak stimulus strength. Next, they received the condition where primes were clearly visible and possessed strong stimulus strength. A cue always validly indicated the target location, but it validly indicated the prime on only half of the trials (i.e. attended).

Numbers 1, 4, 6 and 9 were used as targets; 2, 3, 7 and 8 were presented as primes; the symbol “x” was used as a neutral prime.

Results

Priming effects are expressed by faster RTs to congruent (i.e. prime and target belong to the same category) compared to incongruent trials (i.e. prime and target belong to different categories). Median RTs from correct responses were submitted to a repeated measures analysis with stimulus strength (weak or strong), cue validity (primes attended or not) and congruency (congruent or incongruent) as within-subject factors.

Priming was larger in the strong than in the weak stimulus strength condition (31 VS 6ms, F(1,51)= 35.28, p<.001). Priming was larger for attended than for unattended primes (30 VS 7ms, F(1,51)= 28.07, p<.001). The three-way interaction was also significant (F(1,51)= 15.54, p<.001): priming for weak attended (10ms), strong unattended (11ms) and strong attended (50ms) primes were significant; priming for weak unattended primes was not (2ms).

By including a neutral prime (x), we were able to examine how the priming effects originated: were the RTs on congruent trials facilitated (RT neutral – RT congruent) and/or were the RTs on incongruent trials interfered (RT incongruent – RT neutral)? The table shows the amount of facilitation and interference of RTs as a function of stimulus strength and cue validity.

<table>
<thead>
<tr>
<th></th>
<th>Facilitation</th>
<th>Interference</th>
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<tbody>
<tr>
<td>Weak</td>
<td></td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>Attended</td>
<td>8*</td>
</tr>
<tr>
<td>Strong</td>
<td>-12*</td>
<td>23**</td>
</tr>
<tr>
<td></td>
<td>Attended</td>
<td>22**</td>
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*p < .001, **p < .05

Conclusion

Our results showed that attention (whether the prime received attention or not) and stimulus strength (whether the prime was presented subliminally or not) significantly modulated the observed priming effects: either receiving top-down attention or possessing sufficient bottom-up strength was a prerequisite for a stimulus to elicit priming. When both top-down attention and sufficient bottom-up strength were present, the priming effect was boosted. The processing states distinguished in the taxonomy of Dehaene et al. did not only display a differential pattern of priming effects, the origins of these priming effects also varied between the different processing states. We can conclude that our empirical test further strengthens the taxonomy proposed by Dehaene et al. (2006).

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