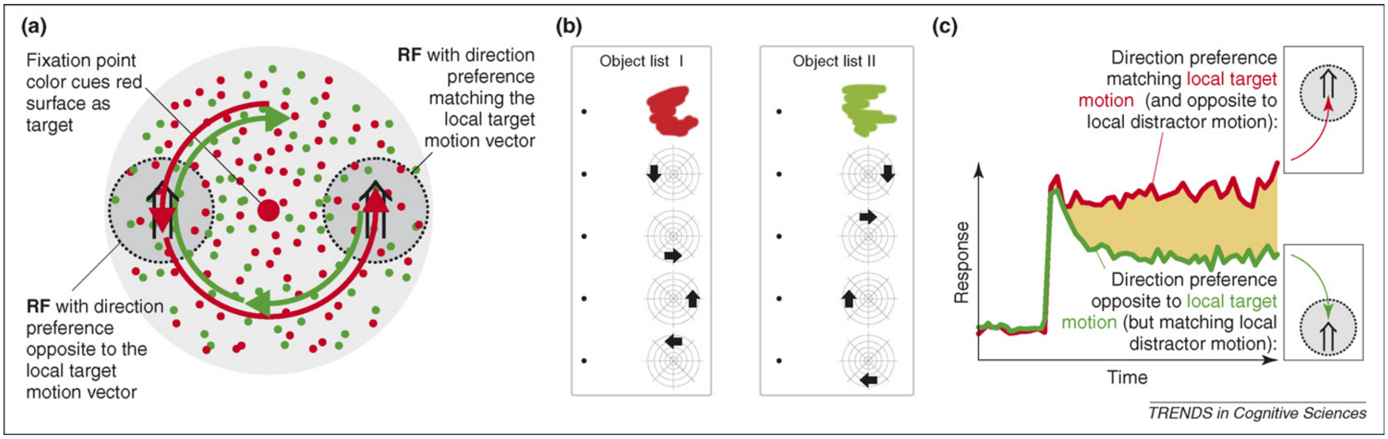

Figure 1. **(a)** Schematic of stimulus configuration in the Wannig et al. study. Attention to the red rotating surface should lead to an enhancement of the cell with receptive field (RF) on the right, but not the one with RF on the left, even though they share the same direction preference. Thus, selection cannot happen based on isolated feature preferences of MT neurons. **(b)** Illustration of the two objects in (a) as lists of features. Attention can find the MT neurons whose responses need to be enhanced by checking whether their feature preferences match features on the target object list. **(c)** Attention effects in direction-selective MT neurons observed in paradigm (a) support local feature matching.

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Letters

READING WORDS, NUMB3R5 and $YMßOL$

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Words in alphabetic languages are processed via their constituents [1]. To recognize a printed word, we need to process the identity and position of its letters, hence distinguishing between *cat* and *fat*, or *dog* and *god*, but not between tABLe and TabLE, or *chair* and CHAIR. Dehaene and colleagues [2] proposed a neuronal model with feed-forward connections only, according to which the brain decodes words through a hierarchy of local combination detectors in the occipito–infero–temporal pathway sensitive to increasingly larger fragments of words. In particular, they tentatively proposed detectors for letter shapes in V4, abstract letter detectors in V8, which represent letters denoting their identities but abstracted from their visual appearance (e.g. CaSe, font, size), and detectors for letter strings in the left fusiform gyrus (LFG). Nonetheless, although activation in the LFG appears to be related to the presence of orthographic structure in the input stimuli, it is still unclear how tolerant the LFG is to deviations of letter identities and whether the system is specialized for the recognition of letter strings [3,4].

Letters, symbols and numbers are usually thought to imply different cortical mechanisms [5,6]. However, NUM83R5 ΔND $YMβ0L$ C4N B€ U$3D Δ$ L3††3R$!N 4 $3N7€NC€, ΔND †H3 R3$UL7!NG $3N7€NC€ C4N B€ UND3R$†00D. Thus, the coding of digits and symbols as letters presents an important challenge to determine whether the LFG extracts and stores abstract patterns during initial presentation of visual objects, or alternatively, if the LFG is formed by domain-specific neurons involved mainly in letter–word identification during prelexical processing.

A recent study using a masked priming paradigm investigated whether words with letter-like symbols and

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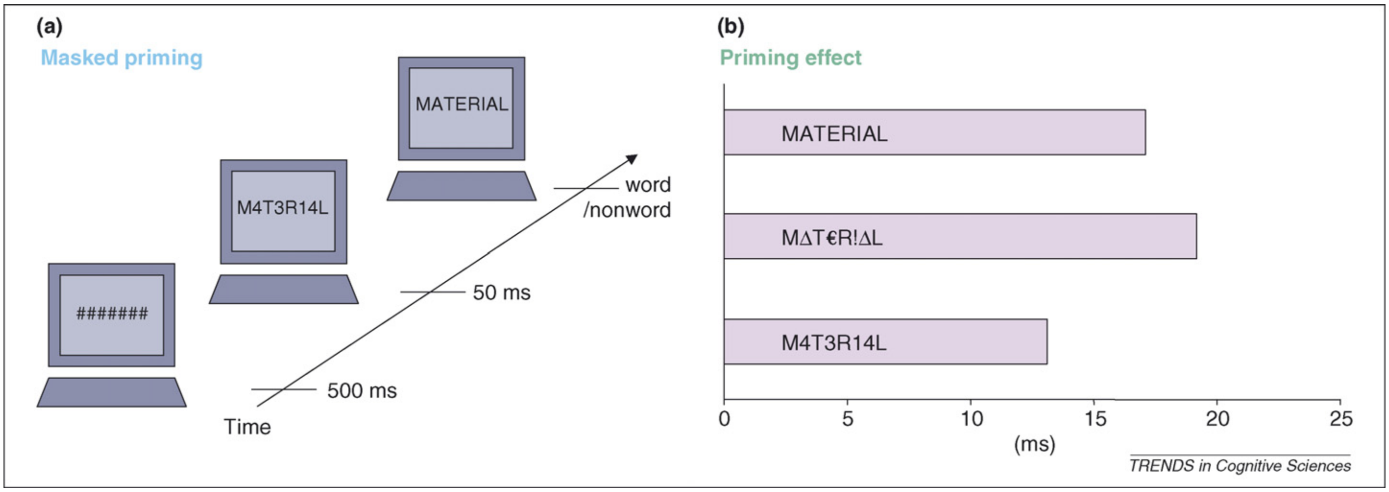

Figure 1. **(a)** Masked priming procedure. **(b)** Net priming effects for the three experimental conditions with respect to the control condition.

Box 1.

The use of numbers as parts of words is called *leet* (or 1337), a visual encryption code that allegedly can be read easily by any human reader (e.g. the digit 3 might look like the letter E), but that would foil most search engines (e.g. strings like l0tt3ry cannot be detected easily). Primes had at least three *leet* digits (e.g. M4T3R14L instead of MATERIAL). The *leet* numbers used were A = 4, E = 3, I = 1, S = 5. In Experiment 1, the prime-target conditions were: (i) identity (MATERIAL–MATERIAL), (ii) related *leet* (M4T3R14L–MATERIAL), (iii) related symbol (M∆T€R!∆L–MATERIAL) and (iv) control letter (MOTURUOL–MATERIAL). The same manipulation was carried out in pseudowords. The reaction times of the three experimental conditions were faster than that of the control, showing similar priming effects (reaction time for control minus that of each experimental condition) (Figure 1). Primes were presented in 10-pt font and targets in 12-pt font to avoid physical continuity between primes and targets. Experiment 2 included two additional control conditions: control *leet* (M6T2R76L-MATERIAL), and control symbol (M□T%R?□L-MATERIAL). Again, reaction times were similar across the three experimental conditions and were substantially faster than the response times in the control conditions. No effects were found for pseudowords in either of the two experiments.

numbers activate their base words [7]. The results were clear-cut: response times to words preceded by a masked prime composed of digits (M4T3R14L-MATERIAL) or symbols (M∆T€R!∆L-MATERIAL) were very similar to response times to words preceded by an identity prime (MATERIAL-MATERIAL), and all of them were faster than those of controls (Box 1 and Figure 1). No effects were found with pseudoword targets. Thus, when they are embedded in words, digits and symbols are encoded in a letter-like manner. This finding suggests that access to whole lexical entries (words) can be achieved somewhat independently of physical form, probably on the basis of some top-down feedback that normalizes the visual input [8]. Information of digits and symbols that resemble letters might not have been accessed. This finding is problematic for the model of Dehaene and colleagues – this model posits a hierarchy of detectors with feed-forward connections only, according to which letters are uniquely identified at a very early stage.

Future research should be aimed at clarifying the following questions: (i) Are the numeric values of the embedded digits and the abstract meanings of the letter-like symbols accessed? (ii) Are the local detectors based on domain-specific neurons? and (iii) Under conscious processing, will the reading of letter-like characters be equally effortless?

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