A short note on number preference

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A SHORT NOTE ON NUMBER PREFERENCE

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Since the early seventies, repeated experiments have shown a general preference, at least in the United States and Europe, for number seven against any other number in the brackets 0-9 (e.g. Simon, 1971; Kubovy and Psotka, 1976). When subjects are asked to choose a number between 0 and 9, 30% of them chose a 7. This "seven phenomenon" gave rise to two research trends that seem to grow apart, each one ignoring the other.

PURELY COGNITIVE APPROACH

In a cognitive science approach, Shepard and Arabie (1979) suggested that the predominance of seven might be explained by mathematical properties of the numbers involved. This idea have been extended and specified by Griffiths and Tennenbaum (2001). Their model is based on two main ideas.

First, when subjects are asked to produce a random-like response (or to pick the first item that comes to mind), they do not actually try to do so. Instead, they try to maximize the probability that their response be random, in a Bayesian way. More precisely, a response x could a priori be random or based on a simple rule (such as giving the first number in the list). The relevant information when it comes to pick up at random an item x is $P(x|\text{random})$. However, subjects actually try to maximize $P(\text{random}|x)$, a quantity that can be computed through Bayesian procedures. In that way, they ascertain that their response is an evidence of randomness.

Second, subjects are sensitive to some properties of numbers: being even, power of 2, or holding special positions such as endpoints (0 or 9), and so on. The less properties a number x has within the list, the greater $P(\text{random}|x)$. There comes number 7, which is the only number that, in the bracket 0-9, shows none of the properties Griffiths and Tennenbaum assume subjects spontaneously consider.

CULTURAL APPROACH

On a totally different basis, many researchers suggested that the number 7 preference can be explained by cultural context. The repetition of the symbol 7 in the Bible, for instance, could well explain its predominance.

Arguments in favour of the cultural approach, and against the purely cognitive view, are determining, and can be categorized in two types of evidence:

First, the cultural dependency of numerical choices is well established. For instance, number 9 outdoes number 7 in Nigeria (Vandewiele et al, 1986), whereas 3 is preferred in Turkey (Koloğlu et al., 2002). Other differences have been recently mentioned as well (Strenge et al., 2009). To the best of our knowledge, cultural differences in lotto players' behaviour have not been mentioned in any publication about number preference, but it provides a confirmation of the cultural approach as well. European players indeed prefer small numbers, and among those number 7 (Roger and Broihanne, 2007), whereas players in Taiwan do show a totally different pattern of choices, preferring 8 over 7, and 36 even more (Hwai-Chung et al., 2006).

Second, the study of psychiatric disorders in relation with numerical choices shows no effect of mental impairment (Koloğlu et al., 2009). A numerical choice based on arithmetical considerations would need healthy executive functions, which does not seem to be the case. Using pseudo-random sequences in a neuropsychological approach, Loetscher and Brugger (2009) even suggest that neglect patients are actually more likely to show enhanced response stereotypy. This result is based on sequential responses properties, but we may assume that stereotypy would mean, in a one-number pick up task, an even greater predominance of seven.

A THIRD WAY?

Considering the above arguments, opposing a purely cognitive approach and a cultural view gives no chance to cognitive theories of numbers preference. However, the two views are not contradictory, and the cognitive approach outmatches the cultural one in terms of predictive power.

The cognitive approach might be made more flexible to encompass some cultural aspects. For instance, one may imagine that the list of number properties subjects are aware of depends upon cultural context, therefore making a difference in the application of the purely cognitive process involved in the response choice.

One interesting feature in the cognitive approach is that it accounts not only for the predominance of seven (in Europe and the USA), but for the whole distribution of responses (e.g. Griffiths and Tennenbaum, 2001).

Even if the *purely* cognitive approach obviously cannot account for cultural dependency, the cultural view could also be a dead end if it does not include cognitive aspects, since it would then be bound to remain qualitative. This is why we advocate "reconciliation" between the two views.

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