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In the attraction, compromise, and similarity effects, alternatives are repeatedly compared in pairs on single dimensions

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ABSTRACT

In multi-alternative choice, the attraction, compromise, and similarity effects demonstrate that the value of an alternative is not independent of the other alternatives in the choice-set. Rather, these effects suggest that a choice is reached through the comparison of alternatives. We investigated exactly how alternatives are compared against each other using eye-movement data. The results indicate that a series of comparisons is made in each choice, with a pair of alternatives compared on a single attribute dimension in each comparison. We conclude that psychological models of choice should be based on these single-attribute pairwise comparisons.

1. Introduction

In the domain of choice between multiple alternatives, the attraction, compromise, and similarity effects demonstrate some puzzling behaviours. Together these effects demonstrate that an individual does not choose by selecting the alternative with the highest value or utility. Instead, an individual chooses as if the value or utility of an alternative is temporarily affected by the other alternatives in the choice set they face. This is puzzling because how much an individual enjoys the car she or he buys, for example, should be independent of the cars he or she does not buy. These context effects are often interpreted as indicating that a choice is reached by comparing available alternatives. This study investigated how alternatives are compared, using eye movement data collected while people make a series of three-alternative choices.

To illustrate the attraction, compromise, and similarity effects, suppose an individual is choosing among different cars. Available cars are described in terms of the two attributes, quality and economy, where Car A is better on the quality dimension but Car B is better on the economy dimension (Fig. 1). The attraction effect is produced by adding Car D to the choice of Cars A and B. Car D is inferior to Car A in both quality and economy dimensions and should thus be discarded but, after adding this decoy, Car A becomes more likely chosen and Car B becomes less likely chosen (Huber, Payne, & Puto, 1982). Adding Car C to a choice between Cars A and B produces the compromise effect. Car C has extremely good quality but poor economy. Importantly, Car C makes Car A a compromise between the other cars, and with Car C's presence, Car A becomes more likely to be chosen than Car B (Simonson, 1989). The similarity effect is produced by adding Car S instead. Car S is similar to Car B, and Car S's introduction results in the higher probability of Car A being chosen than Car B (Tversky, 1972).

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For the non-chosen alternative to influence a choice as described above, an individual has to be comparing alternatives in making a choice (e.g., Simonson, Bettman, Kramer, & Payne, 2013). Here we explore the nature of these comparisons, and consider models involving attribute-wise comparison, alternative-wise comparison, and attribute-and-alternative-wise comparison (see Table 1 for a list of the models).

According to attribute-wise comparison models, one attribute dimension is attended at one moment and all the available alternatives are simultaneously evaluated. In the above car example, an individual may attend, for instance, on the quality dimension of available cars at one moment, and evaluate how advantageous each of the three cars is. Then at the next moment, the individual may attend the economy dimension and evaluate all three cars. This attribute-wise comparison is implemented in multi-alternative decision field theory (Roe, Busemeyer, & Townsend, 2001) and the leaky competing accumulator model (Usher & McClelland, 2001) to explain the three context effects.

In contrast, alternative-wise comparison models assume that all the attributes are integrated before comparison: one pair of alternatives is attended, attribute dimensions are integrated within each alternative, and then the pair of alternatives are compared on their integrated values. In the above example, an individual may integrate the quality and economy dimensions for, for instance, Car A, and also integrate these dimensions, separately, for Car B. Then, the individual compares the integrated value for Car A with Car B. At the next moment, the individual may select a new pair of alternatives, Cars A and S, and repeat the integrate-then-compare process. This integration of information across attributes is commonly assumed in models of two-alternative choice, including models where risk and reward information are integrated into a single expected-value-like measure such as cumulative prospect theory (Tversky & Kahneman, 1992) and the transfer of attention exchange model (Birnbaum, 2008). In the domain of multi-alternative choice, the comparison-grouping model (Tsuzuki & Guo, 2004) implements a mixture of attribute-wise and alternative-wise comparisons to explain the context effects.

Lastly in the attribute-and-alternative-wise comparison, one attribute dimension and also one pair of alternatives are attended at one moment, and two alternatives are compared against each other on the attended attribute dimension. For instance, an individual may attend on the quality dimension and compare Cars A and B at one moment. Then, at the next moment, the individual may focus on the economy dimension and compare Cars A and D. This comparison is assumed in the decision by sampling model (Stewart, Chater, & Brown, 2006), which has been applied to context effects in risky and intertemporal choice (Stewart, Reimers, & Harris, in press) and could potentially be extended to account for the three context effects. The attribute-and-alternative-wise comparison has also been employed in the 2N-ary choice tree model (Wollschläger & Diederich, 2012), and the multi-attribute linear ballistic accumulator model (Trueblood, Brown, & Heathcote, in press).

Table 1
A list of models discussed.

Comparison	Model
Attribute-wise	Multi-alternative decision field theory
	Leaky competing accumulator model
Alternative-wise	Comparison-grouping model
Attribute-and-alternative-wise	Decision by sampling
	2N-ary choice tree model
	Multi-attribute linear ballistic accumulator model

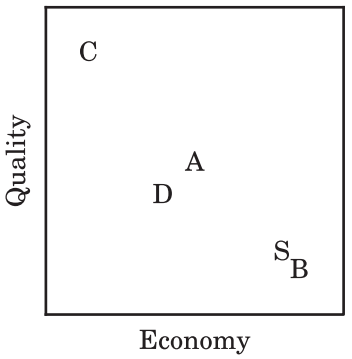

Fig. 1. Illustration of various alternatives. The probability of A being chosen over B can be affected by the presence of D, C or S.

This study examined predictions made by the three types of comparison model. In particular, we tested predictions concerning transitions of attention during choice and effect of random fluctuations in the attention on choice.

1.1. The pattern of attention transition

In attribute-wise comparison, all of the available alternatives are simultaneously compared on a single attribute dimension. Therefore, an individual is likely to fix attention to one attribute dimension and shift their attention back and forth between alternatives to make comparisons. Thus we should see transitions of attention between alternatives within a single attribute dimension more frequently than, or at least equally frequently to, transitions within a single alternative between attribute dimensions. This same pattern of transitions is predicted by the attribute-and-alternative-wise comparison.

In contrast in the alternative-wise comparison models, all the attributes are used simultaneously in each comparison. Therefore, an individual is likely to fix attention to one alternative, shift their attention within the alternative to integrate attribute values, and then make a comparison. Thus we should see transitions of attention between attributes within a single alternative more frequently than, or at least equally frequently to, between alternatives.

1.2. The influence of stochastic fluctuations in attention on choice

When attribute dimensions are weighted equally so that each attribute dimension is equally likely to be attended at any moment, there will still be trial-to-trial