## Joint Models of Item and Source Memory

To this point, we have considered recognition and source judgements separately, however, performance on item recognition and source memory tasks are commonly studied in tandem, which allows for a more comprehensive view of episodic memory than either in isolation. This comprehensive approach is particularly important if we assume that in doing either task, subjects build a mental representation, aspects of which are used to support item and source judgements (Hautus et al., 2008). A major goal of the memory literature was to develop models that provide a joint account of recognition and source judgements. A typical experiment for this purpose sees subjects study items that are associated with one of two sources, A and B, and then are tested on a mixture of A items, B items, and new items that were not studied, N (Batchelder & Riefer, 1990). This paradigm allows for measurement of both the ability to discriminate between studied items and unstudied distractors and the ability to discriminate between source attributes of studied items.

### Multinomial Discrete-State Models

The earliest approach to relating item and source judgements with a mathematical model, taken by Batchelder and Riefer (1990), was to place the two in a processing-tree structure, illustrated in Figure 1, which proposes that when retrieving information about the item in memory, a decision is first made about whether it was previously seen (in SDT terms, the detectability of the signal of an item from noise), and then if the item is deemed to have been studied, a subsequent decision is made about its source attribution. The purpose behind this approach was to measure the proportion of A, B, and N responses considering the numerous ways each response can be generated and the response biases, or inclination to guess, at each stage of the processing tree. A key problem the multinomial model of source memory sought to solve was to separately measure source sensitivity and response bias, two measures that previously difficult to isolate empirically (Batchelder & Riefer, 1990; Batchelder et al., 1994).

Diagram

Description automatically generated

The Batchelder and Riefer (1990) model was built a *high-threshold* view of signal detection, which means that on trials where there is no signal from memory (when the item is actually new), affirmative responses (reporting that the item is old) are only generated as a result of a guess with probability *b* and responses otherwise correctly identify the item as new. In other words, a nonsignal never exceeds the detection threshold, which lends the high-threshold theory its name. High-threshold models have been criticised for making predictions about the shape of the receiver-operating characteristic (ROC; discussed in detail in subsequent sections) that are contrary to single detection and recognition memory data (Bayen et al., 1996; Green & Swets, 1966; Luce, 1963; Murdock, 1974). In his comments on Batchelder and Riefer (1990), Kinchla (1994) argued that because the multinomial model is based on a high-threshold

Bayen, two-high threshold

Klauer Kellen, build on bayen, map states onto confidence ratings.

The key assumption of multinomial models is that they assume that the probabilities of discrete behavioural responses (A, B and N responses) can be mapped onto the probabilities of discrete cognitive states subjects are in (Bayen et al., 1996).

But this can also be interpreted as the process itself- discrete states, Klauer and Kellen.

Continuous models of source memory extend SDT such that memory strength is assumed to vary continuously on two dimensions, bivariate SDT.

(Banks, 2000; Glanzer, Hilford, & Kim, 2004; Mickes et al., 2009).

In its application to the study of memory, SDT proposes that recognition judgements are based on its familiarity- which by analogy is a signal which varies in strength.

In a dual-process view (Yonelinas, 1999), one can respond by directly retrieve an item from memory through recollection, or by simply making a judgement about whether the item is memory or not without retrieving it, based on a feeling of familiarity. In this way, both recollection and familiarity can contribute to successful recognition. On the other hand, in a source memory task, familiarity cannot distinguish between two studied items from different sources, as both items are present in memory and should therefore be equally familiar. Thus, source judgements are thought to reflect a pure recollection process. When performing a recognition task, one can respond by directly retrieve an item from memory through recollection, or by simply making a judgement about whether the item is memory or not without retrieving it, based on a feeling of familiarity. In this way, both recollection and familiarity can contribute to successful recognition. On the other hand, in a source memory task, familiarity cannot distinguish between two studied items from different sources, as both items are present in memory and should therefore be equally familiar. Because source judgements rely only on recollection, the Yonelinas (1999) dual-process model predicts that source judgements should rely purely on a high threshold recollection process. Thus, dual-process and discrete-state models make identical predictions about source memory, but are distinguishable on item recognition.