



Recognition memory performance as a function of reported subjective awareness

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ABSTRACT

Three experiments introduced a recognition memory paradigm designed to investigate reported subjective awareness during retrieval. At study, in Experiments 1A and 2, words were either generated or read (generation), while modality of presentation (auditory versus visual) was manipulated in Experiment 1B. Word pairs (old/new or new/new) were presented during test trials, and participants indicated if they contained an old word by responding “remember”, “know” or “new” in Experiments 1A and 1B, and by responding “strong no”, “weak no”, “weak yes”, or “strong yes” in Experiment 2. Participants were then required to decide which of the 2 words was old. We demonstrated that the proportion measures used in the Remember Know paradigm substantially underestimated the influence of generation on familiarity resulting in an artificial dissociation between indices of knowing (familiarity) and remembering (recollection). We also found a qualitatively different pattern of forced-choice recognition performance as a function of claimed awareness.

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1. Introduction

The subjective, or ‘claimed awareness’, method for measuring conscious awareness has been the source of ample findings and controversies (for reviews see Reingold, 2004; Reingold and Merikle, 1988, 1990; Reingold and Sheridan, 2009). This approach requires participants to report on their subjective phenomenal awareness while performing the experimental task. Although subjective reports have often been met with skepticism, the subjective approach is the oldest and arguably the most intuitive method for measuring awareness. As pointed out by Reingold and Toth (1996), there is a curious discrepancy between the use of the subjective measurement approach in the unconscious perception literature and the unconscious memory literature. Specifically, while the unconscious perception literature has a long history of employing subjective measures of awareness (for a review of early studies, see Adams (1957)), the field of memory has only more recently incorporated such measures, primarily within the framework of the Remember Know (RK) paradigm that was first introduced by Tulving (1985) and later refined by Gardiner (1988) to study subjective states of awareness at the time of retrieval. In advocating the use of the subjective measurement approach, Gardiner and Richardson-Klavehn (2000) argue that “one cannot tell what subjects experience mentally from purely objective measures of their performance. If one wants to be able to take into account subjective awareness of memory, there is no alternative to the use of subjective reports” (p. 230).

In the most commonly used “two-step” version of the RK paradigm, participants are asked to first judge if a given test item was from the study phase (i.e., old) or was not previously presented (i.e., new), and then to further classify each old

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response as either *remember* if they experienced the recollection of episodic details for that item (i.e., specific details concerning their previous encounter with the item), or *know* if they experienced familiarity in the absence of recollection. The overall proportion of recognized old items (hit rate) in each experimental condition is then partitioned based on the subjective classifications provided by participants to form the separate remember and know proportions that constitute the primary dependent measures in this paradigm. Similarly, in another version of the paradigm (i.e., the “one-step” version), participants make a simultaneous “Remember”, “Know” or “New” judgment for each item, and the primary dependent measure is the proportion of items that received each type of judgment. The vast majority of RK studies have explored the differential effects of experimental manipulations on these proportion measures. In summarizing this literature, [Gardiner and Richardson-Klavehn \(2000\)](#) concluded that remembering and knowing are dissociable states of awareness because it has been demonstrated that “some variables affect one or the other of the two states of awareness, that some variables have opposing effects on them, and that some variables have parallel effects on them” (p. 231).

However, the contemporary RK literature is very much divided on the question of whether remember and know judgments reflect two qualitatively different processes or systems. In this debate, single-process accounts contend that remembering and knowing reflect different response criteria along a continuum of confidence or memory strength (e.g., [Donaldson, 1996](#); [Dunn, 2004, 2008](#); [Heathcote, Bora, & Freeman, 2010](#); [Hicks & Marsh, 1999](#); [Hirshman & Master, 1997](#); [Inoue & Bellezza, 1998](#); [Malmberg, Zeelenberg, & Shiffrin, 2004](#); [Rotello, Macmillan, Hicks, & Hautus, 2006](#); [Wais, Mickes, & Wixted, 2008](#); [Wixted & Stretch, 2004](#)), while a competing class of dual-process models interprets remembering and knowing as reflecting the operation of two qualitatively different systems or processes, such as the semantic versus episodic memory systems ([Tulving, 1985](#)), distinctiveness versus fluency processing ([Rajaram, 1996](#)) and familiarity versus recollection ([Jacoby, Yonelinas, & Jennings, 1997](#); for a review, see [Yonelinas, 2002](#)).

Despite this marked lack of agreement over what exactly remember and know responses represent, the RK paradigm is currently being used extensively to make conclusions about the effects of a variety of variables on recollection and familiarity. In reviewing the current state of the RK literature, [Wixted and Mickes \(2010\)](#) noted that the RK paradigm was used in over 30 publications in the year 2009 alone. Importantly, these publications spanned a diverse range of fields and included high profile journals, and “In nearly all of these studies, remember judgments are assumed to reflect recollection, and know judgments are assumed to reflect familiarity (p. 3).”

Given the RK paradigm’s prominence in the literature, it is necessary to work towards a better understanding of the processes underlying remembering and knowing, and of the measures that are used to index them. The main purpose of the present paper is to further examine the RK paradigm’s know response proportion measure, in light of past criticisms of this measure that have arisen out of both the dual-process and the single-process perspectives. To accomplish this goal, we introduce a modified RK paradigm that combines the standard RK paradigm with an approach developed by [Merikle and Reingold \(1990\)](#) in the field of unconscious perception. Accordingly, we begin by briefly describing some of the controversies surrounding the standard RK paradigm, with a focus on past criticisms of the know response proportion measure. We then explain the rationale behind the present approach and report on the findings from experiments employing the modified RK paradigm to examine the effects of generation, (Experiment 1A and Experiment 2) and modality (Experiment 1B) manipulations on the RK response proportion measures as well as on new measures derived from our modified paradigm.

Most relevant for the present context is the controversy surrounding the attempts to use the standard RK paradigm’s know response proportion measure to make inferences about familiarity. In particular, [Jacoby et al. \(1997\)](#) argued that the know response proportion measure tends to provide an underestimation of the contributions of familiarity to memory performance. According to the approach advocated by [Jacoby et al. \(1997\)](#), it is possible for some items to be both recollected and familiar. However, in the RK paradigm participants are forced to choose between either a remember or a know response, and are not allowed to provide both responses to the same item (i.e., response exclusivity). Note that in the RK paradigm, when recollection occurs, regardless of whether or not familiarity is present, participants are instructed to respond remember, and consequently if some items are both recollected and familiar then by definition the know response proportion measure will underestimate the contributions of familiarity to performance.

This underestimation critique has important implications for dissociations that are based on the standard RK paradigm’s response proportion measures of remembering and knowing. Critically, conditions with high levels of remembering may constrain the number of leftover trials that can receive know responses. Thus, the RK paradigm could produce artificial dissociations such that experimental manipulations with a large effect on remembering appear to have a null effect, or even a reverse effect on knowing, even if the manipulation actually has a more parallel effect on recollection and familiarity. [Jacoby et al. \(1997\)](#) used this logic to explain the puzzling finding that know responses to new words (i.e., lures) sometimes exceed know responses to old words (i.e., targets). If knowing reflects familiarity such a finding might suggest a negative familiarity effect such that new words were more familiar than old words. It is hard to envision a conceptual framework that would predict such an effect. Similarly, this criticism might call into question dramatic dissociations such as the one reported by [Parkin and Walter \(1992\)](#) showing that there were higher levels of remembering for younger than older adults, but there were higher levels of knowing for older than for younger adults. In commenting on this dissociation as a function of aging, [Jacoby et al. \(1997\)](#) stated that “Although it may be comforting to think that deficits in recollection are offset by improvements in familiarity, this pattern of results appears to be an artifact of the RK procedure” (p. 35). Specifically, according to [Jacoby et al. \(1997\)](#) knowing is underestimated for young adults because of their higher levels of remembering compared to older adults.

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