



## New Considerations for Memory Assessment

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# New Considerations for Memory Assessment

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**Abstract.** Standard memory assessments typically do not measure all, or even most, facets of human memory. Although some of the more nuanced aspects of human memory, such as the ability to detect familiarity with something despite failing to recall specifics, might seem inconsequential to overall memory function, a growing body of research suggests that these more nuanced aspects of memory may be among the most important components to overall memory function. The present work covers some of the more nuanced aspects of memory function that are largely overlooked in standard approaches to assessing memory function, including the unique role that one's surroundings may play in autobiographical and event memory, the important role that general familiarity-detection ability might play in directing the mind toward memory search effort, why memory oddities like déjà vu and tip-of-the-tongue experiences might be useful and important aspects of memory, and why the multi-modal nature of memory is important to consider.

**Keywords.** Memory Assessment, Familiarity, Familiarity-detection, Scenes

## 1. Introduction

Human memory is multi-faceted, involving different types of information and different ways of exhibiting memory for them. Standard memory assessments have been developed, tested and applied with this understanding in mind [1, 2, 3, 4, 5]. For example, the Memory Assessment Scales measure Verbal, Visual, and Global memory [6] and the Wechsler Memory Scale [7] contains subtests for remembering personal and current information, mental control, digit span, logical memory, visual reproduction, and association learning. However, emerging research suggests that memory is even more nuanced than in the ways captured through standard neuropsychological testing, and in ways that are important to consider [8]. An example of a memory ability not captured by standard memory assessments is the phenomenon of Highly Superior Autobiographical Memory (HSAM), a rare condition in which a person can remember nearly every experience. When given a date and a year, someone with HSAM can state what day of the week that date fell on and what significant newsworthy events happened on that day, as well as other verifiable details such as what the weather was like [9, 10]. Despite this exceptional ability, people with HSAM tend to show unremarkable memory performance on standard neuropsychological assessments [11] and standard memory laboratory tasks [10]. Thus, whatever is at the heart of this exceptional memory ability is not captured in standard memory assessments. HSAM may result from superior consolidation of

memories over time [12], which itself is not a part of typical memory assessment procedures. Below, I describe several more nuanced facets of human memory that are likely getting missed in standard memory assessments and for which there is reason to believe they are important.

## **2. Nuanced Facets of Human Memory that are Likely Important**

### *2.1. Memory for One's Surroundings*

One of the more nuanced aspects of human memory concerns the role that one's surroundings play in it [13]. The demonstrated role of scene information in autobiographical and episodic memory [14,15] and the shared neural mechanisms between spatial navigation and episodic memory ability [16] has led to the recent suggestion that episodic memory may be memory for the scene from one's surroundings at the time of the encoded experience [17]. However, as reviewed in [13, 15], nearly all standard memory tasks hold the person's surroundings constant throughout the task. The person is typically sitting in the same room throughout the encoding and retrieval portions of the memory task, either using a computer in front of them or with cards or pencil and paper. Their surroundings are unchanging throughout the memory task while memory for a series of things within that constant set of surroundings is examined. Even episodic memory is typically tested this way, with the most common procedure involving studying a list of words and then later being given a test a short time later on memory for those words. Yet, in real-life, different memories of different events take place in changing sets of distinct surroundings, and evidence suggests that the surroundings in which something occurred are a critical component of human memory [13, 14, 15].

It may not have been feasible in decades past to try to incorporate changing sets of surroundings into memory assessment tasks (as it would entail having to physically move across different settings as part of the memory assessment task); however, the advent of virtual reality (VR) makes this feasible today. The VR task used by [13] does so. In it, participants are immersed within randomly ordered successively changing scenes. Participants are later tested on their memory for scenes that earlier served as their VR surroundings using a combination of spatially similar and dissimilar scenes as cues and counterbalancing test scene cues across participants regarding whether they corresponding to studied or unstudied scenes. All facets of scene memory that were examined (e.g., cued recall of scenes, familiarity-detection with scenes spatially resembling encoded scenes, etc.) were enhanced when the scenes had been encoded as VR surroundings compared to when the scenes were encoded as images from a 2D screen in a room that was unchanging throughout the task. This suggests that it is not just scene *stimuli* that play a uniquely important role in memory, but scenes as *surroundings*, and this aspect of memory can be captured using VR.

### *2.2. Familiarity-detection*

Another of the more nuanced aspects of human memory that is not usually considered in assessment is familiarity-detection, which refers to a general sense of recognition that something was encountered in the past, as opposed to recalling a specific instance in which that situation was previously encountered. As it is thought to result from global resemblance to information stored in memory [18], familiarity-detection can occur when

a situation resembles a previously encountered situation, and it can occur even without recalling any specific prior relevant experience [13, 19, 20, 21, 22, 23].

Although the ability to detect familiarity with something despite failing to recall specifics might seem inconsequential to overall memory function, increasing evidence suggests familiarity-detection is likely an important component to overall memory function. Not only might intact familiarity-detection ability during other memory impairment be useful for rehabilitative purposes, but feelings of familiarity during recall failure are associated with likely proxies of memory search effort, such as an increased tendency to generate candidate information (commission errors), to devote increased time trying to retrieve the critical piece of information, and to exhibit elevated curiosity [13, 24]. An initial familiarity-detection mechanism may indicate the presence of something in memory before it gets retrieved, and such familiarity-detection may even determine whether or not an *attempt* to retrieve occurs [25, 26]. As such, familiarity-detection may be a significant modulator of attention, “flipping” attention inward toward retrieval search effort when familiarity is detected [27]. Whereas factors like novelty and salience draw attention outward toward the novel or salient stimulus for encoding, familiarity-detection instead likely sends attention inward toward memory retrieval search effort. This assertion is consistent with recent evidence suggesting that attention switches from being externally oriented to being oriented internally toward memory [28] as well as with neural evidence suggesting that the same neural circuit is involved in mutually exclusive hippocampal encoding vs. retrieval modes [29].

Thus, an overlooked possibility in memory assessment is that familiarity-detection is a critical neural mechanism that modulates the direction of attention in ways potentially important to the rest of cognitive function. Methods of measuring familiarity-detection when recall fails [13, 18-24] hold promise for tapping into this mechanism and its potential to drive attention inward toward memory search effort. A failure to detect familiarity in the environment may underlie some memory and attentional deficiencies.

### *2.3. Tip-of-the-tongue Experiences*

Another nuanced aspect of human memory not typically considered in assessment is the subjective sensation of a tip-of-the-tongue (TOT) experience, which occurs when a person feels on the verge of retrieving a word [30]. In the cognitive psychology literature, TOTs are measured by directly asking people if they feel that they are experiencing a TOT state for a given target word [30, 31]. TOTs are particularly relevant to cases of word anomia (clinical cases of extreme word retrieval failure). However, in assessments used in the clinical literature, rather than directly asking people for their subjective reports regarding whether or not a TOT state is present for the unretrieved word, TOTs are instead inferred in naming tasks on the basis of other potential proxies for TOT states, such as an ability to articulate partial target information or to gesture relevant information about the target [32, 33]. This type of indirect inference-based measuring of TOTs is problematic because research has demonstrated differences between partial attribute generation and the subjective sensation of a TOT state, and that TOT states are associated with an increased tendency to simply guess at candidate partial attributes without being correct [31]. As past clinical work has suggested that people with left Temporal Lobe Epilepsy (TLE) are more prone to word anomia than people with right TLE [33], it is important to distinguish between word anomia that is mere word retrieval failure unaccompanied by a subjective TOT state and word anomia that is word retrieval failure accompanied by a subjective TOT state. A reason why this is important is because the

subjective sensation of a TOT state has useful qualities, such as prompting motivation, curiosity, and persistence at trying to find the answer [34, 35], which in turn could be capitalized on in rehabilitative strategies for patients with anomia. A way to address this gap in the future would be to incorporate a simple question into standard naming tasks used in memory assessment so that every time a person fails to retrieve a word in the naming task, they are asked if they are experiencing a TOT sensation for the word.

#### *2.4. Déjà vu*

Déjà vu—the striking feeling of having experienced something before when that seems impossible—is a facet of human memory that is rarely formally considered in memory assessment. Although seemingly just an interesting memory quirk or oddity, it actually has great clinical relevance. One of the most well-documented ways that déjà vu is relevant to assessment is in regard to medial temporal lobe (MTL) seizure disorders. Frequent déjà vu is often an indicator of seizure activity originating in the MTL [36]. Thus, when used in conjunction with other assessments, the frequency with which a person experiences déjà vu can be a useful indicator of the status of the neural circuitry underlying their memory system and of whether or not the person might be experiencing subclinical or focal seizures that might otherwise go undetected. A measure of a person's déjà vu frequency commonly used in research is the Inventory for Déjà vu Experiences Assessment (IDEA) [37]. This assessment tool could be used alongside other assessment measures to gain a fuller picture of a person's memory function and neural status.

#### *2.5. The Multi-modal Nature of Memory*

Finally, another facet of human memory that should be considered for the future of memory assessment is the multi-modal nature of memory. Memory in day-to-day life does not occur for individual pieces of information that occur in isolation. Instead, memory is multi-faceted, involving encoding one's surroundings and one's place within those surroundings at the same time as encoding surrounding people's identities, what people are saying, people's voices, the soundscape accompanying the visual surroundings, the emotions accompanying the experience, and many other facets. Thus, memory assessments that include a multi-modal informational format could potentially detect more nuanced memory difficulties while also presenting more potential avenues for rehabilitative strategies. A step in this direction has been developed by [8]. They created an immersive gaming environment where the participant experiences a real-world scene in which someone is talking to them and events are happening (such as someone in the background shooting basketball hoops). This method allows for multiple aspects of memory to later be tested, such as face recognition, name recall ability, and object location memory, among others, and thus holds promise as a future memory assessment method.

### **3. Conclusions**

The discovery through minimally invasive surgical interventions for the treatment of epilepsy that affected aspects of memory can go undetected by standard memory assessments [8], along with a number of new findings in cognitive psychology [27, 13,

34] suggest a need for new approaches to memory assessment that examine more nuanced facets of memory as well as that examine memory in more life-like contexts. A number of promising approaches are laid out here that have the potential to expand the current repertoire of available memory assessment tools to help provide a more comprehensive picture of a person's overall memory function and likely neural status. In addition to the above-mentioned suggested avenues, future memory assessment should also incorporate longer-term memory testing to include memory consolidation mechanisms over time as part of the assessment process as well.

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