**Cue-Dependent Forgetting Bias**

**Bias Definition**

Cue-dependent forgetting bias, also known as retrieval failure, is a phenomenon where the ability to recall information is hindered due to the absence of cues or triggers that were present at the time the memory was encoded. Memory recall is significantly improved by the context or cues that were associated with the initial encoding of the information. These cues can be environmental (such as the place where the learning occurred), emotional (the emotional state at the time of learning), or semantic (related to the meaning of the information).

**Ten scenarios of Cue-dependent forgetting Bias**

1. **Exam Stress:** A student studies thoroughly for an exam but finds themselves unable to recall information during the test. Later, seeing a classmate's doodle related to a study topic triggers a flood of remembered information.
2. **Work Presentation:** An employee prepares a detailed presentation but freezes when starting to speak in the meeting room. Later, while discussing casually with a colleague in the break room, they recall all their points effortlessly when a similar topic comes up.
3. **Recipe Recall:** A chef learns a new recipe but can't remember the steps while cooking in a different kitchen. Back in their own kitchen, seeing a specific type of spatula they used while learning the recipe helps them recall all the steps perfectly.
4. **Language Learning:** A person learning a new language can't remember certain vocabulary words during class. Later, hearing a song in that language, they suddenly remember the words because the melody acts as a memory cue.
5. **Driving Directions:** A driver forgets the route to a friend's new house but remembers every turn the moment they pass the familiar coffee shop they visited near the friend's neighborhood.
6. **Athletic Performance:** An athlete struggles to perform a new routine during practice. However, on the competition floor, seeing the familiar logos and colors of their team's banner helps them recall and perfectly execute the routine.
7. **Musical Memory:** A pianist forgets how to start a piece of music during rehearsal. Seeing the original sheet music cover they practiced with, not just any sheet music, triggers a perfect recollection of the piece.
8. **Acting Lines:** An actor forgets their lines during a dress rehearsal on a new stage. Back in their usual rehearsal space, the familiar setting and props help them recall their lines without error.
9. **Shopping List:** A shopper forgets several items they need while at the store. Walking back into their kitchen at home, they immediately remember the missing items because the home environment acts as a cue.
10. **Historical Facts:** A student struggles to recall details for a history exam. Later, while watching a historical documentary with visual cues similar to their study material, they remember all the facts they couldn't during the exam.

**User Story for the scenario "Exam Stress"**

It's the end of the semester, and Alex has been preparing for the final physics exam for weeks. Despite feeling well-prepared the night before, Alex experiences a surge of anxiety as the exam begins, causing a critical formula to slip from memory at a crucial moment. Halfway through the exam, Alex encounters a problem that requires the use of this specific formula. Despite knowing they've used it multiple times before, the stress of the exam environment makes it impossible to recall. Frustrated and anxious, Alex moves on to other questions, leaving that part blank.

As time dwindles, Alex reviews their answers, and when revisiting the problematic question, a seemingly unrelated memory flashes through their mind: a joke made by their study group about the formula. This cue, tied to a relaxed and humorous moment, suddenly triggers the forgotten formula's recall.

**Competency questions**

1. **What did Alex want to recall during the final physics exam?**

Alex wanted to recall a critical physics formula.

1. **What specifically helped Alex recall the forgotten formula?**

Alex remembered a joke made by his study group related to the formula. This seemingly unrelated memory served as a cue that helped him recall the formula, he had forgotten due to exam stress.

**Classes and properties**

Version of Ontology builder from Chat GPT

Classes:

1. **CognitiveBias**

* Represents the overarching concept of cognitive biases.

1. **CueDependentForgetting** (subclass of CognitiveBias)
   * A specific cognitive bias where the ability to recall information is dependent on cues present at the time of encoding and at the time of retrieval.
2. **MemoryConcept**
   * Represents concepts or ideas related to memory and forgetting, such as specific memory processes or phenomena.
3. **LearningContext**
   * Represents the context or environment in which learning occurs, including specific situations that might affect memory retention and recall.
4. **StudyStrategy**
   * Represents strategies used by students to aid in their learning and memory recall, including methods to overcome cue-dependent forgetting.
5. **Student**

Properties:

1. **isAffectedBy** (domain: Student, range: CognitiveBias)

* Describes a relationship between entities on the base of influence.

1. **employsStrategy** (domain: Student, range: StudyStrategy)
   * Represents the study strategy a student uses to improve learning and memory recall.
2. **associatedWithContext** (domain: StudyStrategy, range: LearningContext)
   * Represents how a study strategy is associated with a specific learning context or environment.
3. **understandsConcept** (domain: Student, range: MemoryConcept)
   * Represents the memory concept a student understands, such as the principles behind cue-dependent forgetting.
4. **relatesExperienceToConcept** (domain: StudyStrategy, range: MemoryConcept)
   * Represents how a study strategy relates a student's personal learning experience to a memory concept.

Our Changes

Classes:

1. **BiasedAgent**

* Represents an entity that experiences the bias.

1. **Trigger**

* Represents an environmental or contextual stimulus that facilitates the recall of memories by a BiasedAgent. Has types depending on the provenance of the trigger: context-dependent (referring to the environment) and state-dependent (referring to the person experiencing the bias).

1. **Reproducing**

* Models the process of recalling and possibly reconstructing memories. This class deals with how an agent processes and reproduces information from memory.

Properties:

1. **hasTrigger** (domain: Situation, range: Trigger**)**

* Signifies the stimuli, conditions, or events that initiate or activate a specific cognitive process.

**Framester Frames**

We used these frames for the classes’ alignment:

* **People** (<https://w3id.org/framester/data/framestercore/People>)

This frame contains general words for Individuals, i.e. humans. The Person is conceived of as independent of other specific individuals with whom they have relationships and independent of their participation in any particular activity. They may have an Age, Descriptor, Origin, Persistent\_characteristic, or Ethnicity. A man from Phoenix was shot yesterday. She gave birth to a screaming baby yesterday. I study 16-year-old female adolescents. I am dating an African-American man. She comforted the terrified child. I always thought of him as a stupid man.

Here is used to denote a human being and express that we are talking about human cognitive biases.

cbi:BiasedAgent => classification:isClassifiedBy=>fs:People

* **Memorization** (<https://w3id.org/framester/data/framestercore/Memorization>)

A Cognizer applies oneself to commit a Pattern to memory, so that the Cognizer would recognize future examples of the Pattern or be able to reproduce it. A gaggle of students were frantically memorizing the answers out in the hall. It is possible to memorize by rote and at the same time have a full grasp of the underlying meaning.

We use this frame to model memorizing activity.

cbi:BiasedAgent => reaction:performs => fs:Memorization

* **Information** (<https://w3id.org/framester/data/framestercore/Information>)

A Cognizer knows or comes to know some piece of Information about a Topic. In this frame, many LUs encode a specific Means\_of\_Gathering and/or Source, but these may also be expressed separately.

We use this frame to describe the information which the person would like to memorize.

fs:Memorization => crm:usedSpecificObject =>fs:Information

**Ontology Design Patterns**

We used this pattern to model the bias.

* **Situation** (<http://ontologydesignpatterns.org/wiki/Submissions:Situation>)

To represent contexts or situations, and the things that are contextualized.

* **Classification** (<http://ontologydesignpatterns.org/wiki/Submissions:Classification>)

To represent the relations between concepts (roles, task, parameters) and entities (person, events, values), which concepts can be assigned to. To formalize the application (e.g. tagging) of informal knowledge organization systems such as lexica, thesauri, subject directories, folksonomies, etc., where concepts are first-order elements.

* **Experience and Observation** (<http://ontologydesignpatterns.org/wiki/Submissions:Experience_%26_Observation>)

To represent the epistemological "missing link" between a cognitive activity, e.g. the interaction with a cultural object, and any evidence of the effects this activity has on the individuals that are engaged with it; what can collectively be considered as an experience.

* **Reaction** (<http://ontologydesignpatterns.org/wiki/Submissions:Reaction>)

To model dynamic situations, tracking agents and actions they produce, events that are results of some action(s), and consequences as new actions, i.e. reactions.

* **Sequence** (<http://ontologydesignpatterns.org/wiki/Submissions:Sequence>)

To represent sequence schemas. It defines the notion of transitive and intransitive precedence and their inverses. It can then be used between tasks, processes, time intervals, spatially locate objects, situations, etc.

**Entities and properties from other resources**

**Dbpedia**

* **dbo:Knowledge** (<https://dbpedia.org/page/Knowledge>)

Can be defined as awareness of facts or as practical skills and may also refer to familiarity with objects or situations. Knowledge of facts, also called propositional knowledge, is often defined as true belief that is distinct from opinion or guesswork by virtue of justification. While there is wide agreement among philosophers that propositional knowledge is a form of true belief, many controversies in philosophy focus on justification: whether it is needed at all, how to understand it, and whether something else besides it is needed. These controversies intensified due to a series of thought experiments by Edmund Gettier and have provoked various alternative definitions. Some of them deny that justification is necessary and replace it, for example, with reliability or the man.

**CIDOC Conceptual Reference Model**

* **crm:used specific object** (domain: Memorization, range: Information OR domain: Reproducing, range: Knowledge)

(<https://cidoc-crm.org/html/cidoc_crm_v7.1.3.html#P16>)

This property describes the use of material or immaterial things in a way essential to the performance or the outcome of an instance of E7 Activity. It implies that the presence of the object in question was a necessary condition for the action.

* **crm:has type (is type of)** (domain: Trigger, range: predefined string ("context-dependent", "state-dependent"))

(<https://cidoc-crm.org/html/cidoc_crm_v7.1.3.html#P2>)

This property allows sub-typing of entities – a form of specialization – through the use of a terminological hierarchy, or thesaurus.

* **crm:isAbout** (domain: Knowledge, range: Information) (<https://cidoc-crm.org/html/cidoc_crm_v7.1.3.html#P129>)

This property documents that an instance of E89 Propositional Object has as subject an instance of E1 CRM Entity. This differs from P67 refers to (is referred to by), which refers to an instance of E1 CRM Entity, in that it describes the primary subject or subjects of an instance of E89 Propositional Object.

**Bibliography**

Tulving, Endel, «Cue-Dependent Forgetting: When we forget something we once knew, it does not necessarily mean that the memory trace has been lost; it may only be inaccessible», vol. No. 1, fasc. American Scientist, January-February 1974, Vol. 62, 2024, pp. 74–82.

«Cue-Dependent Forgetting - Psychology: AQA A Level», s.d. https://senecalearning.com/en-GB/revision-notes/a-level/psychology/aqa/2-1-13-cue-dependent-forgetting.