| INFORMACIÓN DE LA CONVOCATORIA | |
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| **NOMBRE DE LA CONVOCATORIA** | **AÑO** |
| Trabajos de grado – 2019 - I | 2019 |

| INFORMACIÓN GENERAL DEL PROYECTO | |
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| **TÍTULO DEL PROYECTO** | Formal Representation of Feeling of Familiarity as a Metacognitive Judgement in Metacognitive Architecture CARINA |
| **DURACIÓN (MESES)** | 12 Meses |
| **LÍNEA DE INVESTIGACIÓN INSTITUCIONAL** | Cognitive computing |
| **GRUPO DE INVESTIGACIÓN** | Cognitive Informatics & Cognitive Computing |
| **FACULTAD** | Educación y Ciencias Humanas |
| **DEPARTAMENTO** | Informatica educativa |

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| INFORMACIÓN FINANCIERA DEL PROYECTO | |
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| **FUENTE DE FINANCIACIÓN** | **VALOR SOLICITADO** |
| Unicordoba | **$0 pesos** |
| **TOTAL** | **$0 pesos** |

**RESUMEN**

Haga una descripción breve del problema abordado, el objetivo planteado para resolverlo, la metodología aplicada, los resultados conseguidos y las conclusiones y recomendaciones (Máximo 500 palabras).

The Feeling of Familiarity (FOF) is a metacognitive judgment whose activation occurs when perceiving a

stimulus coming from the environment, in the current research is presented the formal and semantic representation of a FOF in metacognitive architecture CARINA. A FOF is presented as a production rule, which has the following fields; condition, assert, strategy, next and else. Also, is presented the formal and semantic representation of a reasoning trace and the semantic representation of a belief in CARINA'S metacognitive architecture. Finally, the presentation and explanation of a software prototype (FOF software) created to test the process that seeks to create in CARINA for the activation of a metacognitive judgment, in this case Feeling Of Familiarity. Also, the results obtained from the tests carried out with this and the conclusions obtained in the realization of the current investigation are shown.

## INTRODUCCIÓN

Haga una breve introducción del desarrollo del proyecto, la justificación para la ejecución, los objetivos que se plantearon y el alcance de los mismos con la ejecución del mismo (Máximo 800 palabras).

A Feeling of Familiarity (FOF) is a metacognitive judgement, product of inferential processes (Efklides, 2002) A person can experience a feeling of familiarity to find a stimulus about which one knows little (Mike, Oaksford, NicK and Chater, 2010). A metacognitive judgment is the process of evaluating about the knowledge of something, how easily it has been learned and if the learning has been successful (Rosenthal, & David. M, 2000). FOF is seen as a by-product of the perception and the comprehension of stimulus events (Rosenthal, David. M 2000) Perception is probably primarily responsible for weak or powerful feeling of familiarity that occur without actually recalling the target event (Kronlund, Antonia, Bruce, Whittlesea, and Carolyn, Yoon, 2017) The perception cognitive function has been developed in cognitive architectures as a main feature that allows the agent to obtain information about the environment, and use the perceived to dynamically maintain an effective representation of this (Gracián, Triviño. Barros,2008)

A cognitive architecture is a computational modeling platform for cognitive tasks, which must offer representation formats, as well as reasoning and learning mechanisms to facilitate modeling (Ron Sun,2006) When a cognitive architecture is applied to human cognition, it can offers an experimental framework that allows modeling and testing a hypothesis about its functioning (Miguel, Madrid, 2011). A metacognitive architecture provides a concrete vision for the accurate modeling of elements for a high level of reasoning in an AI agent about its functions (Caro, Manuel. F., Darsana. P., Josvula. Adan. A. Gomez, and Catriona. M. Kennedy,2018 )

CARINA is a metacognitive architecture for artificial intelligent agents, derived from the MISM metacognitive metamodel, the levels that compose it are called the object level and meta-level. Currently, CARINA does not have a metacognitive process that allows it to make a search in a quick time and obtain a short response such as metacognitive judgments, which will allow the cognitive architecture to evaluate the learning and knowledge acquired by the cognitive agent. For this reason, these judgments must be located in the CARINA meta-level to generate traces of reasoning that are activated by perceiving a representative stimulus from previous experience. In addition, they should be able to adapt these stimuli to the current state of the agent and determine whether it is known or unknown. The objective of this work is to show the formal representation of a feeling of familiarity as metacognitive judgments in the memory system of a cognitive agent backed by CARINA's metacognitive architecture.

## MARCO TEÓRICO Y ESTADO DEL ARTE

Consigne el marco teórico y estado del arte que soportaron el desarrollo de la investigación (Máximo 3000 palabras).

## 1. Metacognitive judgements

Metacognitive judgments are routinely used to evaluate the functioning of cognitive processes and, in particular, the degree to which these processes have worked or will function correctly (Mike, Oaksford. Nick. Chater, 2010) Metacognitive judgments can be supported by the intentional use of beliefs and memories. These are characterized by evaluate if we know something or how easily we will learn or even if we have learned it successfully (Rosenthal, David,2010) People do not have easy access to memory traces, but their metacognitive judgments are based on several available keys (Bajšanski, Igor, and Maja. Močibob,2014) In metacognitive judgments, the processes of fluidity of the stimulus are related to the performance of a proposed task (Mole, Callu, Jersakova, Georgios, K Kountouriotis., Chris J A Moulin, and Richard M Wilkie,2018 )

The metacognitive judgments that have had the most attention in research are the judgments related to the sensation of knowing "FOK Feeling of knowing", the "TOT tip of the tongue" judgments and the "JOL judgments of learning" judgments (Antonio & Requena, 2010) According to (Crowder & Friess, 2011) Metacognitive Judgements in an AI system, have important implications about how the system learns and uses memory. For example, the system can judge if it has enough information to complete a mission, known as learning trials.

The FOF may also contain for its activation a multimodal neuronal system, which is independent of the sensory modality that triggers it (France,2010) Therefore, people in most cases haven't knowledge about limitations whose satisfaction resulted in the feeling of familiarity (Dienes, Zoltan, Scott, and Lulu 2011)

A feeling of familiarity, can also be experienced as a primitive quality that is not learned from the functioning memory system (Endel, Tulving, Henry and Roediger Varieties 1989), and seen as a non-analytic process based on the fact that feelings of familiarity are automatic and there is no voluntary control to recognize and collect information (Jacoby, Lawrence, Kelley, and Dywan,1989)

## 2. Perception cognitive function

Perception is input from world to mind (Alva and Noe, 2004 ) Perception process can be defined as the way in which the stimuli that are received from the outside are interpreted through the senses (Irene, Adriana, and Hernandez Gomez, s.f.) The perception is the elaborated sensory data; this means that perceiving is not just feeling, it must also attribute meaning or give meaning to what is perceived(Cosacov and Eduardo, s.f.) distinction of the essential characteristics of the stimulus, comparison of characteristics, creation of an appropriate hypothesis and the comparison of the hypothesis with the original data (Haro, Mediavilla and Mendez, 1989)

For Metacognitive Architecture, (MIDCA) (Michael Cox, 2013) the cognitive function perception consists of the cycles of "perception-action" both at the cognitive level (Object) and the metacognitive level (Goal). A cycle selects a goal and commits to achieve it, the agent perceives changes in the environment as a result of the actions, interprets the perceptions respect to the plan and evaluates the interpretation respect to the goal.

In CARINA, Cognitive Function Perception is a cognitive function composed of various elements: mental states, goals, actions and production rules, these behaviors interact with each other, when a stimulus is perceived until it's converted into a fact or a primitive structure of declarative knowledge that will be

temporarily stored by the minimum processing unit of your reasoning cycle. According to (Caro Manuel, 2015) the goals are objectives set to achieve a task or a process, the Actions refer to the methods that are used by the agents to perform each task in the plan and the mental states. A mental state is considered a representation where a plan can be construct to realize tasks in order to accomplish a goal.

In Fig. 1 it's shown in CARINA each goal, mental State, action, preconditional mental State and post conditional mental State that belongs to its Perception Cognitive Function.

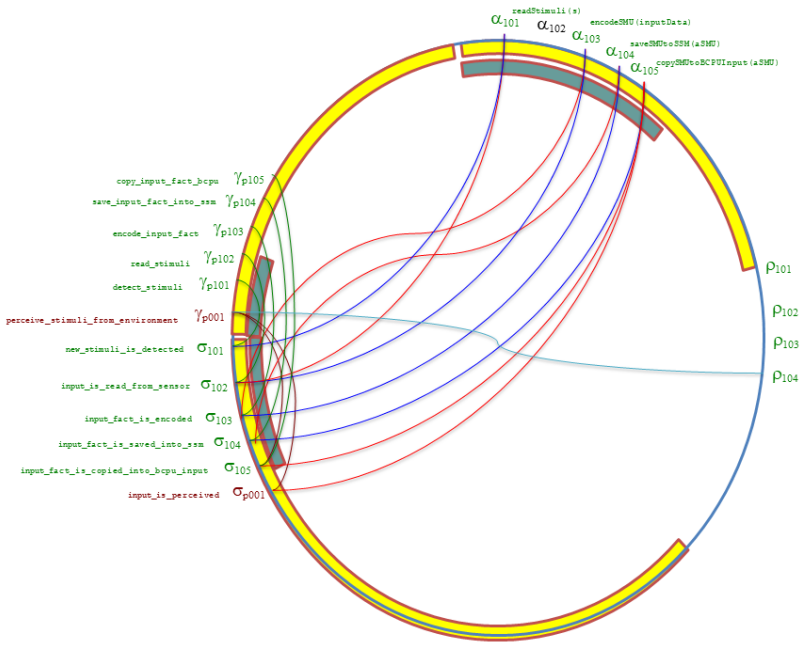



**Fig N°1 (**Cognitive Function Perception In CARINA) (Flórez, Gómez & Caro, 2018)

Fig. 1 *Goal* $\gamma_{\rho 101}$ named *detected_stimuli* points to *new_stimuli_is_detected* which is *Mental State* $\sigma_{101}$. This Mental State is modified by *Action* $\alpha_{101}$ named *ReadStimuli,* which in turn has a *Precondition* $\sigma_{pre}$ named *pre_read_stimuli*., FOF is presented as a rule (p) in the figure.

## 3. Reasoning trace in CARINA's perception cognitive function

A trace of reasoning is a set of mental operations whose function is to describe and produce changes in mental states, selecting the operators of the problem and even resulting in the solution plan of a cognitive agent (Cox, Michael. T,1999 )
In the cognitive perception function of CARINA, a trace of reasoning is composed of three elements: Goals ($\gamma$), mental states ($\sigma$) and actions ($\alpha$). The goals point to a mental state, this mental state is associated with an action, so a trace of reasoning is a sequence of objectives, which leads to a mental state and is finally associated with an action. Formally, a trace of reasoning ($\rho\tau$) of the cognitive function of perception of CARINA is a tuple of 5, that is:

$\rho\tau \triangleq < \gamma, \sigma, \alpha, \sigma_{pre}, \sigma_{post} >$ (1)

Where:

$\rho_T$ Is a reasoning trace of cognitive function Perception in CARINA.

$\gamma$ Is a set of goals that belongs to CARINA's Perception Cognitive Function

$\sigma$ Is a set of mental states that belongs to CARINA's Perception Cognitive Function.

$\alpha$ Is a set of actions that belongs to CARINA's Perception Cognitive Function

$\sigma_{pre}$ Is a set of preconditional mental states that belongs to CARINA's Perception Cognitive Function.

$\sigma_{post}$ Is a set of post conditional mental states that belongs to CARINA's Perception Cognitive Function.

### 3.1 COMPUTATIONAL IMPLEMENTATION OF A REASONING TRACE

For the purposes of this research, Perception Cognitive Function Behaviors in CARINA can be represented as a directed graph, in Fig. No 2 as seen:

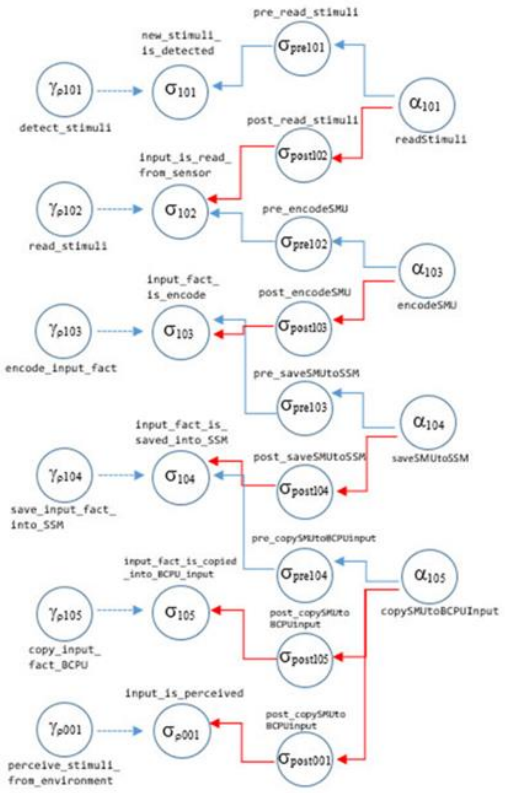



**Fig N°2 (**Representation of Behaviors of Perception Cognitive Function through a Directed Graph**)**(Flórez, Gómez & Caro, 2018)

From the list of adjacency shown in Fig. 3 it can be affirmed that a trace of reasoning in the cognitive function Perception in CARINA is a linked list of Beliefs conformed by two essential components: a Head that has the name of a trace of reasoning as well as a set of characteristics of the cognitive function and the Steps that belong to this trace that are Behaviors activated when the cognitive function is executed.

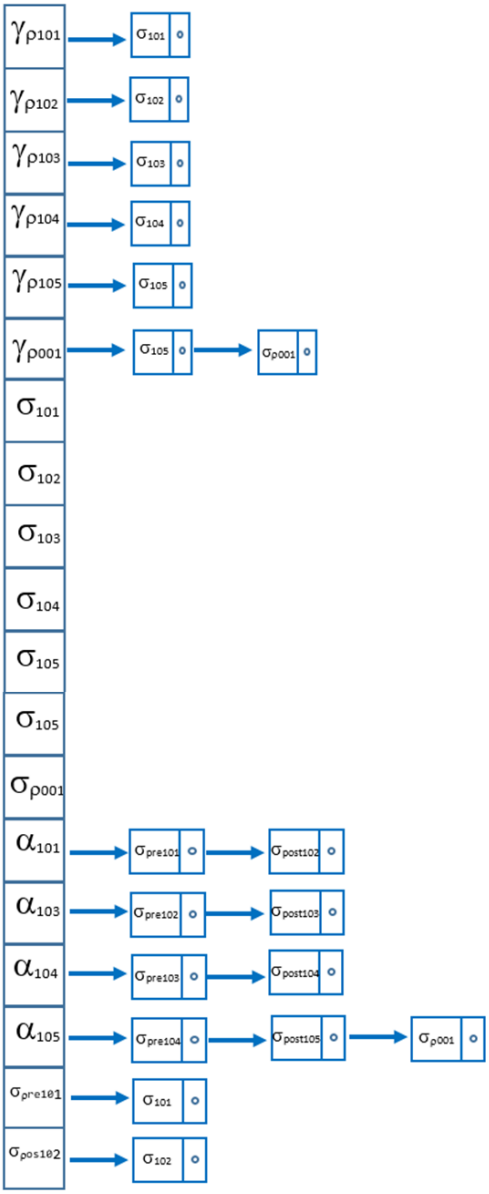



**Fig N°3 (**Representation of Behaviors of Perception Cognitive Function through an Adjacency List) (Flórez, Gómez & Caro, 2018)

### 3.2 Semantic Representation of Reasoning Trace

In Fig. 4, the goal $\gamma_{\rho 101}$ is symbolized according to the belief with the detected name of the stimuli, this corresponds to the goal category (Type SMU: goal) and has a mental state called status_metrics_is_detected its current value is false while that the goal value is true. This goal $\gamma_{\rho 101}$ points to a belief called new_stimuli_is_detected, which symbolizes the mental state $\sigma_{101}$ that corresponds to the category mental_state (TypeSMU: mentalState) and has a false current value. The belief that represents action $\alpha_{101}$ is called read_stimuli and corresponds to the category action (TypeSMU: action) which has a pre-condition called pre_read_stimuli and a postcondition called post_read_stimuli. These conditions are represented as beliefs

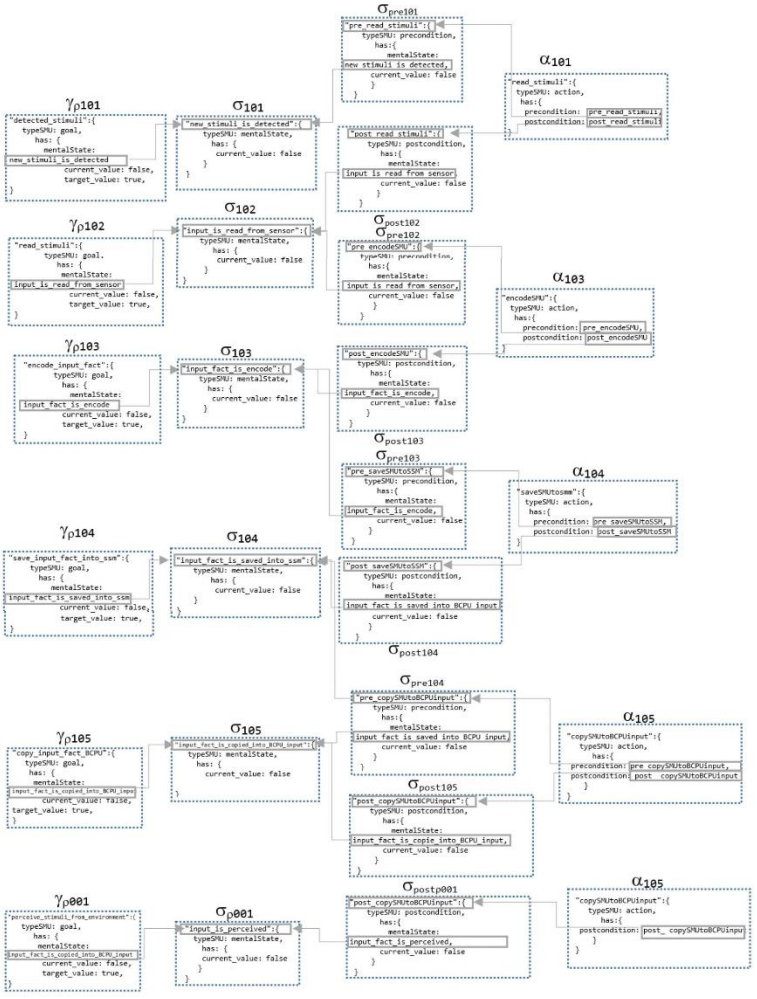



**Fig N°4** ( semantic representation of a reasoning trace) (Flórez, Gómez & Caro, 2018)

Figure N°5 shows the representation of reasoning trace through beliefs. the reasoning trace has a heading that corresponds to the category Resonance Tracing (TypeSMU: ReasoningTrace) and has an ID: CF1025 identified with the cognitive function; the cognitive function has a start time of execution of B: 30: 25.001; at a given moment the cognitive function stops executing E: 30: 25.002; IP: detection, visual, active, sequential, which symbolizes the input of the cognitive function; OP: P01C01 as a result of the cognitive function; the σpre that is the pre-condition of the cognitive function; σpost which is the precondition that occurs after the cognitive function is executed; G: detected stimuli that symbolize the main goal of cognitive function; SG, which symbolizes a set of sub-goals of cognitive function; and SS symbolizes the succession of mental states of cognitive function.

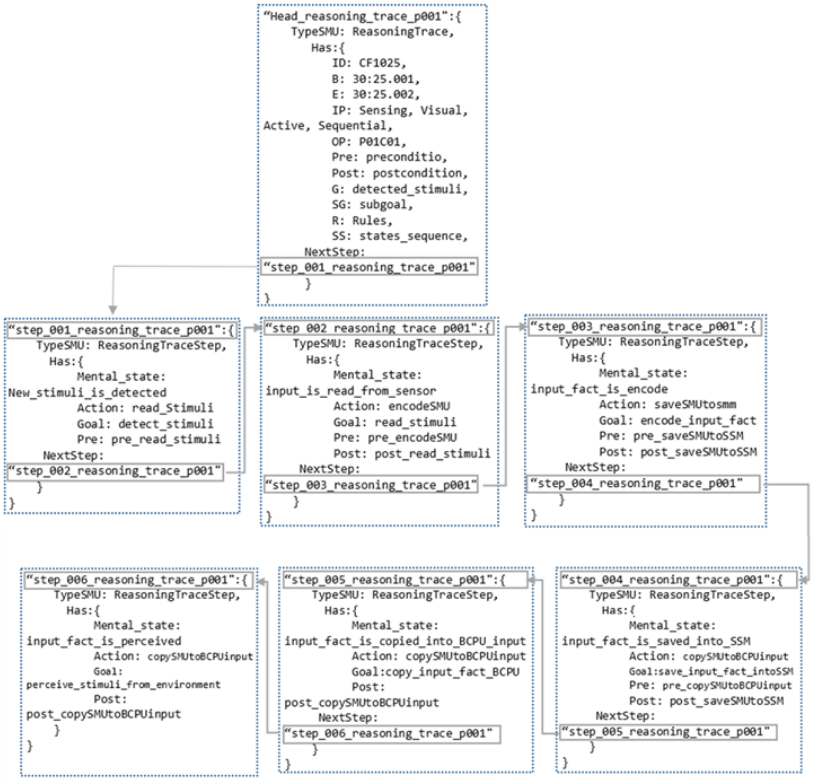



**Fig N°5 (**Representation of reasoning trace through beliefs.) (Flórez, Gómez & Caro, 2018)

Finally, the reasoning trace has a NextStep: step_001_reasoning_trace_p001, which is the next step that pertains to this crawl. each step has a category, to which it belongs: ReasoningTraceStep (TypeSMU: ReasoningTraceStep); It has a mental state, an action, a goal, a precondition, a subsequent condition if it has one, and points to the next step that the cognitive function performed activates the corresponding behaviors at that particular moment.

## 4. Metacognitive architecture CARINA

CARINA is a metacognitive architecture for artificial intelligent agents. CARINA emerges from the metacognitive MISM meta-model (Caro, Josyula, Cox,, Jiménez, 2014) CARINA is structured on self-regulation and metamemory supported by metacognitive mechanisms of introspective monitoring and meta-level control; for this reason, CARINA has a functional approach to the philosophy of mind (Fodor,1975) (Piccinini,2010) (Scheutz,2001) According to (Machamer, Darden, and Craver,2000), the mechanism contains entities and activities that include static as well as dynamic aspects. In CARINA the set of entities are called "cognitive elements". Considering MISM, there are three types of cognitive elements that CARINA'S has.

I) Structural elements: containers to which are added functional and basic elements; they have as their main element in their structure the "cognitive level".

II) Functional elements: based on tasks that contribute to the reasoning process and decision making.

III) Basic elements: set of elements that interact in the processes of reasoning.

The key functional elements in CARINA are:

I) *Reasoning tasks (RT):* defined as operations that lead to processing, transformation, reduction, processing, storage and retrieval of information using knowledge and decision making to achieve the objectives of the system.

II) *Metareasoning tasks (MT):* used to explain errors that arise in a specific reasoning task, they can also be used to choose between "cognitive algorithms" and perform the reasoning process (Cox, M.T, Raja,2012 )

CARINA has two cognitive levels called object level and Meta level.

I) *the object level:* its composed of the model of an artificial intelligent agent to reason about the world, that is, the environment of the agent solving problems (Caro, M.F, Josyula, Cox, M.T, Jiménez,2014) This level is based on cognitive functions such as problem solving or memory recovery (France,2010 ). In CARINA, the object level has stages which are sets of cognitive functions (FQ), as shown in Fig. 6: Perception phase (perception FF), Situation evaluation phase (Evaluation phase of the situation, categorization FQ, recognition FQ), reasoning phase (Reasoning CF, Belief Maintenance CF, decision-making CF), Problem solving stage (planning CF, prediction CF), interaction stage (CF of interaction, CF of communication) and Stage of action (CF of action).

II) *The meta-level:* it's composed of a dynamic model of object level (Cox, M.T, 2005)
The meta-level contains the components, knowledge and mechanisms that are needed for a system to monitor and control its learning and reasoning processes. CARINA's Metalevel is composed of two types of metacognition:

*Self-regulation:* is a type of metacognition that at the object level is responsible for monitoring and controlling the reasoning process, contains two stages, which are sets of metacognitive functions (MCF)

- Monitoring stage (identification MCF, detection MCF, explanation MCF and objective generation MCF)

- Control stage (strategy selection MCF)

*Metamemory:* metamemory is an element of metacognition (Cox, M. T., Oates, T., Perlis, D, 2011 ). In CARINA Metamemory is a mechanism that is responsible for adapting the changes that occur in the constraints of a memory task (caro, josyula and jimenez, 2013). It contains four stages that are sets of metacognitive functions (MCF).

- Monitoring Stage (Identification MCF, MCF of Detection).
- Metacognition Search Stage (MCF Explanation of Objectives, MCF Explanation).
- Judgment Stage (Judgment MCF).
- Control Stage (MCF Selection Strategy).

In CARINA the reasoning process takes as a reference beliefs, assumptions and expectations. To reach a mental conclusion for example, categorization. This is a central cognitive activity that allows an agent to increase the state of knowledge that it possesses. The process of problem solving is related to the reasoning process since it is assigned a goal in the world or within the agent, the agent takes it and orders its actions to achieve it. The monitoring of the realization of a plan leads to revised estimates about the effectiveness of the plan and finally to a decision to follow another course of action. The decisions in CARINA are associated with the recognition of a situation or pattern, both mechanisms are combined in a cycle of recognition and action that take place in all cognitive behavior. To finally act, which implies the representation and storage of motor skills that give way to the activities stored in the Procedure Memory.

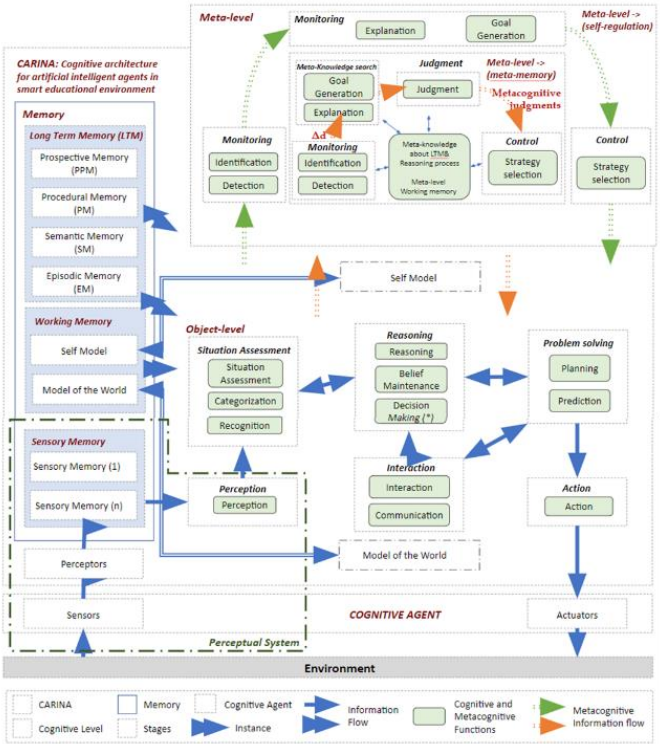


**Fig N°6** (Structural view of CARINA) (Caro, Josvula, Gomez & Kennedy, 2018)

It is important to highlight that in current research on the feeling of familiarity no current studies have been found, which are aimed at the implementation of metacognitive judgments such as this in the structure of cognitive architectures, but there are experiments focused on this metacognitive judgment that have put tested in humans to know the functioning and causes of FOF activation.

according to (Plailly et al., 2007) in an experiment of the feeling of familiarity made with music and smells, the activation of a semantic memory system independent of the stimulus modality that triggered it was observed, in the study it was concluded that upon receiving stimuli from musical compositions and odors, neuronal bases located in the left hemisphere were activated, in turn involving other regions of the brain for semantic processing and recognition memory, activating FOF.

on the other hand (Torres Moraga, E, 2019) in a study conducted to measure the confidence of Internet users with information banking through familiarity, it concluded that users feel more secure with Internet banks in which they have already had previous interactions; When a FOF is triggered on the site to which the user has accessed, there are greater possibilities that he decides to use it and reaffirms his confidence taking into account the previous experiences according to the information obtained at a previous time and the same interaction that was had with the site in a previous experience.

## OBJETIVOS

Formule el objetivo general y los objetivos específicos que dirigieron la ejecución del presente proyecto.

**General:**

- Create a mechanism that triggers a Feeling of Familiarity as a metacognitive judgment in the metacognitive architecture CARINA.

**Specific:**

- To formally represent a Feeling of Familiarity as metacognitive judgment in metacognitive architecture CARINA.
- Represent semantically a Feeling of Familiarity as a metacognitive judgment in the metacognitive architecture CARINA.
- Computationally implement a Feeling of Familiarity as metacognitive judgment in metacognitive architecture CARINA.
- Perform an experiment that allows to verify the effectiveness of FOF in the cognitive function perception of the metacognitive architecture CARINA.

## MATERIALES Y MÉTODOS

**En el caso de métodos empíricos** (cualitativa, cuantitativos o mixtos): Coherencia del enfoque y diseño investigativo con la naturaleza del problema, descripción y justificación de la población objeto de estudio, coherencia de categorías o variables del estudio con el problema y los objetivos planteados, pertinencia de

procedimientos propuestos para obtener y analizar la información.
**En el caso de métodos lógicos** (formales o de soporte): es decir, para el caso de proyectos de desarrollo tecnológico o innovación, enuncie las metodologías de análisis, diseño, desarrollo implementación, validación o mantenimiento que utilizó en el desarrollo del proyecto.

The methodology of this research is an engineering methodology in which the creation of software is proposed that will serve as the basis for the solution of a problem, which will establish the communication characteristics that will govern the development of the software (Abud Figueroa, 2009)

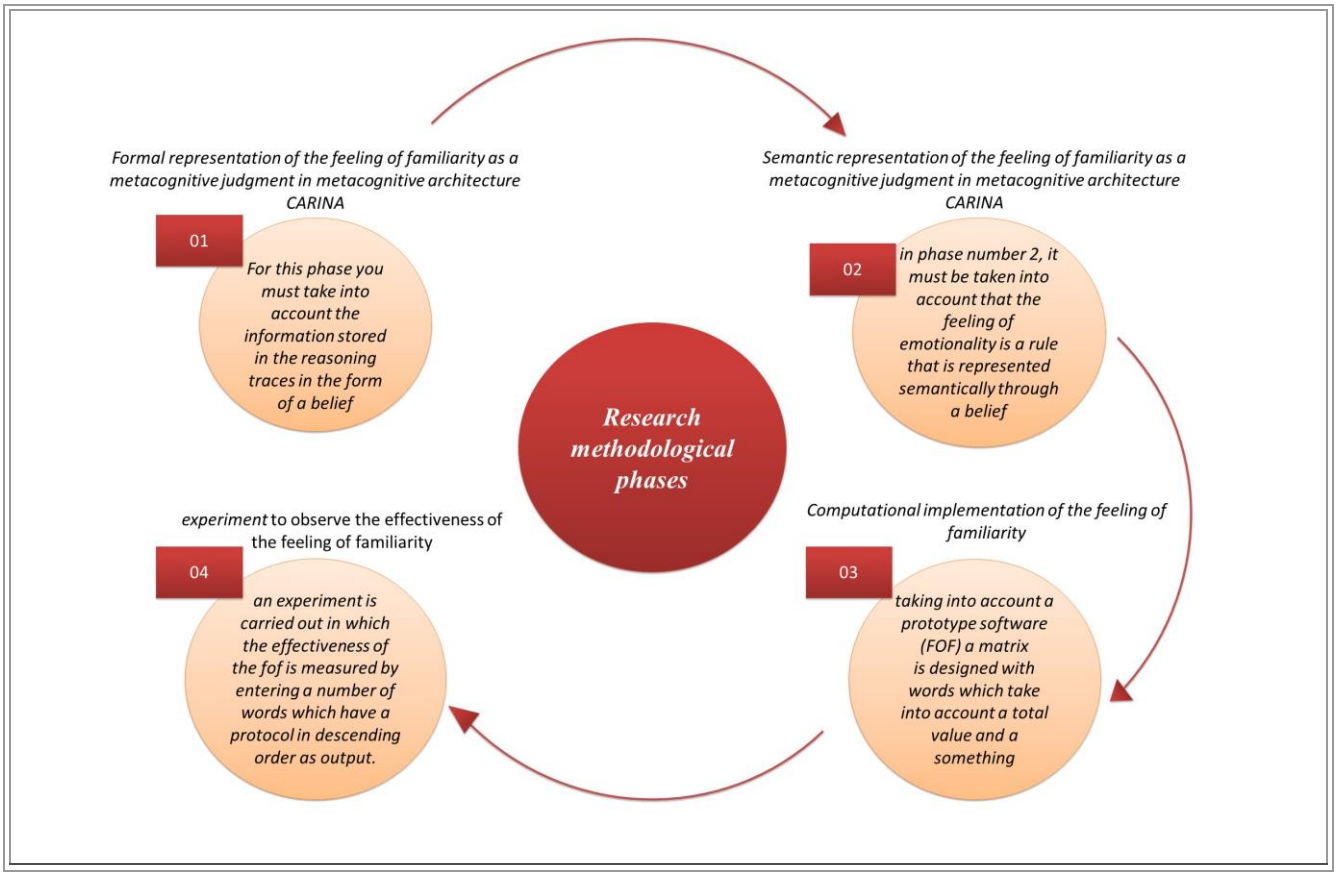
The current study begins to develop a theoretical framework and a state of the art that brings together the latest research in cognitive computing, cognitive computing and metacognition in computing considering design of cognitive and metacognitive processes through computers.

This process will continue its development considering the following phases of the investigation, each one has relation with a specific objective of the investigation. These phases are:
The first phase seeks to formally represent a feeling of familiarity as a metacognitive judgment in CARINA metacognitive architecture, considering the information stored in the head of the Reasoning traces in the form of beliefs.

In the second methodological phase, is semantically represented a feeling of familiarity as a metacognitive judgment in the metacognitive CARINA architecture, taking into account that in CARINA a FOF is a production rule that is represented semantically through a belief, taking the information stored in the heads of the reasoning traces that are in the IP and OP fields corresponding to the input and output of the cognitive function.

In the third phase, was computationally implemented a Feeling of familiarity as a metacognitive judgment in the metacognitive architecture CARINA.

Finally, in the fourth phase, is carried out an experiment to verify the effectiveness of FOF in the perception cognitive function of the metacognitive Architecture CARINA.




## RESULTADOS Y DISCUSIÓN

Describa los resultados obtenidos con base en los objetivos planteados y discútalos a la luz de los fundamentos científicos que los soportan y resultados de otras investigaciones.

**Result 1 - Formal Representation of Feeling of Familiarity**

According to (Caro, Manuel. F, 2015) in CARINA, a Judgment is a basic element included into the Metacore category of the MISM Metamodel. This author states that a Metacognitive Judgment is a Judgment performs in the Metalevel which evaluates events that occur at the object level. These metacognitive judgments provide information that is used by the system to establish if it has the capacity to propose a solution given by reasoning failure. A Feeling of Familiarity (FOF) is a metacognitive judgment whose purpose is evaluating the degree of knowledge of the cognitive agent about the information from a stimulus that has been perceived, about a certain object or event. The above description in the Figure N°7 is shown.

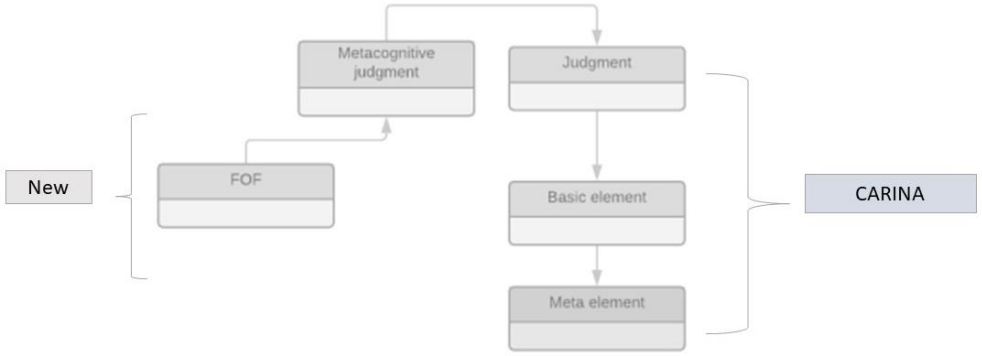



**Fig N°7** (Metacognitive judgment FOF) (own authorship)

Formally, in CARINA a FOF is represented as a production rule. According to (Nalepa, Grzegorz J, 2016 )a production rule is a conditional statement which is used to express factual knowledge. In CARINA, a production rule (ρ) is defined as follows (Caro, Manuel F., Adán A. Gómez., and Juan C. Giraldo, 2017):

$$\rho: \Psi \wedge A_1 \in t_1 \wedge A_2 \in t_2 \wedge \ldots \wedge A_n \in t_n$$
$$\rightarrow Assert(C_1 = c_1, C_2 = c_2, \ldots, C_n = c_n)$$
$$Strategy(H_1 = h_1, H_2 = h_2, \ldots, H_n = h_n)$$
$$Next\ (j), Else\ (k).$$

With:

• $A = \{A_1, A_2, \ldots, A_N\}$ with $A_1 \in t_1 \wedge \ldots \wedge A_n \in t_n$ At the object level, the declarative metacognition is represented as a set of elements of a cognitive function.

• $H = \{H_1, H_2, \ldots, H_n\}$, with $(H_1 = h_1, H_2 = h_2, \ldots, H_n = h_n)$. Algorithms that associate the state of a cognitive function are the representation of the procedure meta-knowledge

• The rule (ρ) represents the strategic meta-knowledge of CARINA.

• The declaration of affirmation represents the new knowledge included in the knowledge base, it says to learn new facts of some type of knowledge.

To shoot a FOF, it must be taken into account that the information obtained from the stimulus that was perceived has a set of characteristics where one of them must stand out to be taken as a potential indicator for the activation of this feeling. Formally a FOF it's represented as follows: $\Phi^O$
$\Phi^{O\Phi}$={ ρ }

**Result 2- Semantic representation of a FOF in metacognitive architecture CARINA**

Feeling of Familiarity (FOF) is a metacognitive judgment which is a rule, which in turn is a conditional state that has the fields: condition, assert, strategy, next and else. In the field algorithm are codes of cognitive actions that are executed in a cognitive function. See Fig N°8

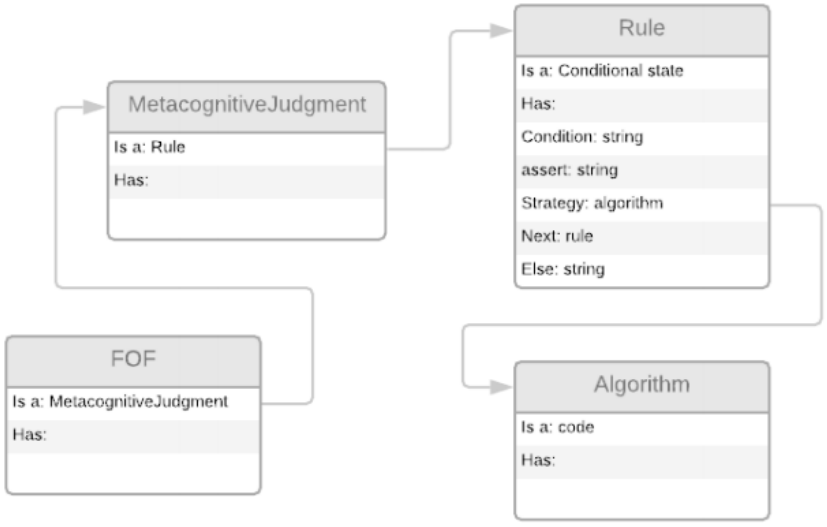



**Fig N°8** (FOF Semantic Representation) (own authorship)

Taking into account that a FOF evaluates the knowledge that a cognitive agent has about a stimulus, it is taken as a reference that FOF will have the task of evaluating the data stored in the heads of the reasoning traces in CARINA, as highlighted in the red frame shown in Fig N°9

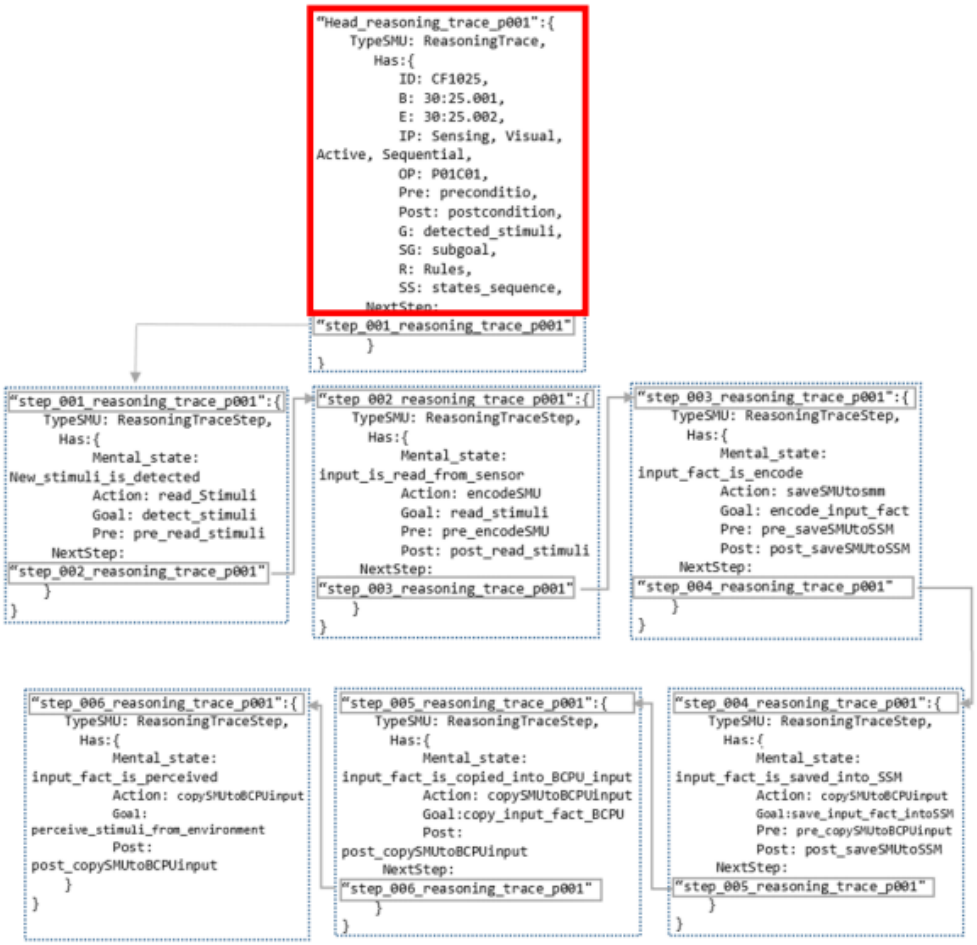



**Fig N°9** (Data stored in the heads of the reasoning traces in CARINA) (Flórez, Gómez & Caro, 2018)

Finally, in CARINA, FOF will be used to assess the degree of knowledge of the agent, taking into account that through the semantic representation it was concluded that a FOF evaluates the knowledge of a cognitive agent verifying the information that has the heads of the reasoning traces stored in the semantic memory of CARINA.

**Result 3 - FOF Software**

CARINA is a metacognitive architecture in which the stimuli are covered by the sensors, which must have the ability to know what kind of stimulus has been received; In CARINA, the cognitive perception function is responsible for taking the stimulus, taking into account that this function is conformed by computational strategies, at the end of executing the strategies, the stimulus is coded in the form of a fact, keeping it in the sensory memory and then copied in the BCPU.input becoming the perceptual output.

subsequently, the reasoner to see that perception has fulfilled all its computational strategies executes the cognitive function Recognition in which the first computational strategy is to shoot an FOF, so that this feeling is triggered a search is performed in the Self model in its last item where CARINA's metacognitive judgments are housed, When this trial is triggered it proceeds to perform a flat index search, which is made up of the basic characteristics of all the beliefs found in CARINA's semantic memory.

Semantic memory contains a network of beliefs that are each of the heads and nodes of the reasoning traces that have been executed in CARINA. on the other hand, the FOF when finding a co-residence between the stimulus and the one found in the flat index, through the ASSERT reveals if the information received through the received stimulus is familiar or is a novelty, in the STRATEGY a weight, taking into account that in the case of a novelty a weight (1) is assigned instead if it is familiar to CARINA a (+1) will be added to the weight, this STRATEGY is currently in theory, in the case of NEXT will start the next estimate and finally in ELSE it is saved if it is a novelty, this is represented as a rule. (see figure N ° 10),

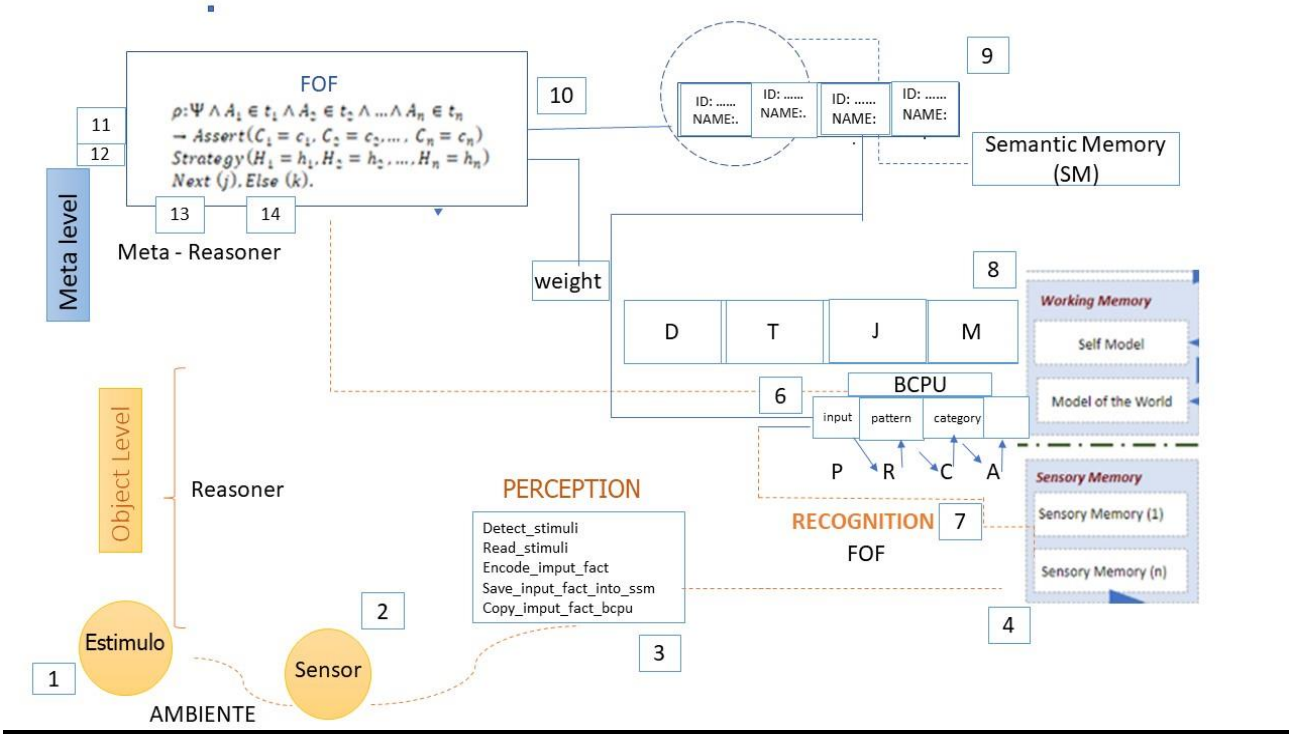



**Fig N°10** (Activation Of FOF In Carina) (own authorship)

The creation of a flat index is necessary so that the entire network of beliefs does not have to be accessed, for this purpose the identification of the content of the words (ID) is taken as reference and the long-term memory is not accessed; instead, the index will be trimmed with a simple matrix which will act as an index of semantic memory in CARINA.

The matrix that was created would be postponed to give way to the use of the flat index, this would be the one that would be traveled to obtain a quick access to the memory, this process will be responsible for the recognition function, the reasoner will execute the plan and call for its execution.

Taking into account that each of the cognitive functions of the object level are performed in a chain, so that the point in the FOF is reached, the cognitive recognition function will be activated and will access the flat index and trigger the FOF if what was perceived is familiar or if it should be seen as a novelty, considering that this can be an action that the object performs when it encounters an unknown stimulus.

For this research a software prototype (FOF Software) was carried out. This includes some main functions, the first one is called app.post and is responsible for creating a browser route within the prototype in which a record post is received, sending a word through a text string to be processed, taking into account that there is logical processing.

```
app.get('/', function (req, res) {
  res.render('index');
});

app.post('/', async function(req, res) {

        let recongized = []

        let runTask = []

        let { matriz } = require("./data/matriz");

        let text = req.body.text;
```

The matrix is required and once the text arrives a slipt function is performed, this is a function of javas scrip that is responsible for dividing the words by a parameter in this case is a space, crossing and dividing the words one by one.

```
text.split(" ").forEach(function(word) {

    if(matriz[word] != undefined){

      recongized.push(matriz[word]);

    }
```

Then a concatenation of objects is carried out, where the words in the matrix are verified, if it is found different from the others it is because it found a new word, saving it in recognized that it is an array, otherwise it triggers a protocol, each arrangement consists of different words with a total and in its algorithm this information is extracted, when sending a set of words an arrangement is shown with all the words found with its total and its algorithm, which in a beginning are shown in the console in disorder, to see it by priority a second function is executed, which is in charge of comparing and organizing the arrangement, taking it into

account the total value and algorithm and then proceeding to organize it by the total value remaining in descending order.

```
const ListOfProcess = recongized.sort(compareValues('total',
'desc'));

        console.log(ListOfProcess);
```

The next date now function is responsible for measuring the time it takes to execute executing to send an output, to measure the time the list of processes that is carried out is traversed.

```
ListOfProcess.map(task => {
                runTask.push({ task: task.algorith, time:
Date.now() });
        })

        console.log(runTask);

        totaltime = 0;
```

Finally to not receive the execution time individually, a process is executed where a greater number of words are validated at the time, all these are added and divided among the index of the array, taking into account the amount of times and the total of each one, achieving a general total.

```
        runTask.map( (time) => {
                totaltime += time.time
        })

        totaltime = totaltime / runTask.length;

        console.log(totaltime);
```

This prototype of software was developed, to test through an algorithm the operation of a feeling of familiarity taking into account that in the case of CARINA when a stimulus is perceived in this case a Word through the cognitive function, the information received that was perceived is stored in the header of the reasoning traces in the form of belief, the word entered to have a semantic weight is classified, to evaluate later if it's known or not, give way to the activation of familiarity.

To achieve this, one of the elements used was a development engine called **NODE.JS** (Java scripting development engine based on b8), as well as the use of a data weight matrix or double matrix, the data entered was weighted to perform statistical calculations within the algorithm itself.

It came to the creation of the project in xpress, taking into account the use of the aforementioned matrix in which each of the incoming data is validated, through a view form, basically this prototype interacts with the matrix asking if there is data inside it. Through a function that collects the data it receives from the form, calculating and averaging the information coming from it and validating if there is a match; for this, take all the information found on the right side of the matrix and proceed to generate an algorithm that validates the

results of which are those words that have greater weighting.

After proceeding to call the matrix that previously should have been created, in the case of CARINA cannot be empty to search results within its own memory, this matrix should be stored within the short-term memory, because it is from where the information stored with the source will be validated to launch the corresponding protocols.

when the protocol is launched, so that it can work it receives from a form a text variable that comes from a chain of string text of a form, when it arrives an explicit function is created that what it does is to return an array coming from the chain of text for words. That is to say, it divides them, for example: by saying "it will be a day full of love and happiness" for the case of CARINA will bring in the first array love, in the second happiness and so will anger ordering according to its semantic weight.

In the prototype, when the explicit is done, it is traversed and then validated in the matrix if that word is known and found a relationship or not, forming a condition, the information is saved in an array called Recognized, once that have the arrangement of known words, a function is executed that compares in the arrangement what percentage of words should go, acting as a function of ordering words, which in this case would be a ordering of protocols, to order them Each matrix should have on its right side propagation of deviation a total that would be equivalent to CARINA's need to execute this algorithm.

For example, the weight of love is 20 and happiness 18 (see matrix in figure N°11) this tells CARINA that first she must execute the protocol of love and then the protocol of happiness, in descending order, once ordered, that provision is covered and each of the protocols becomes functions.

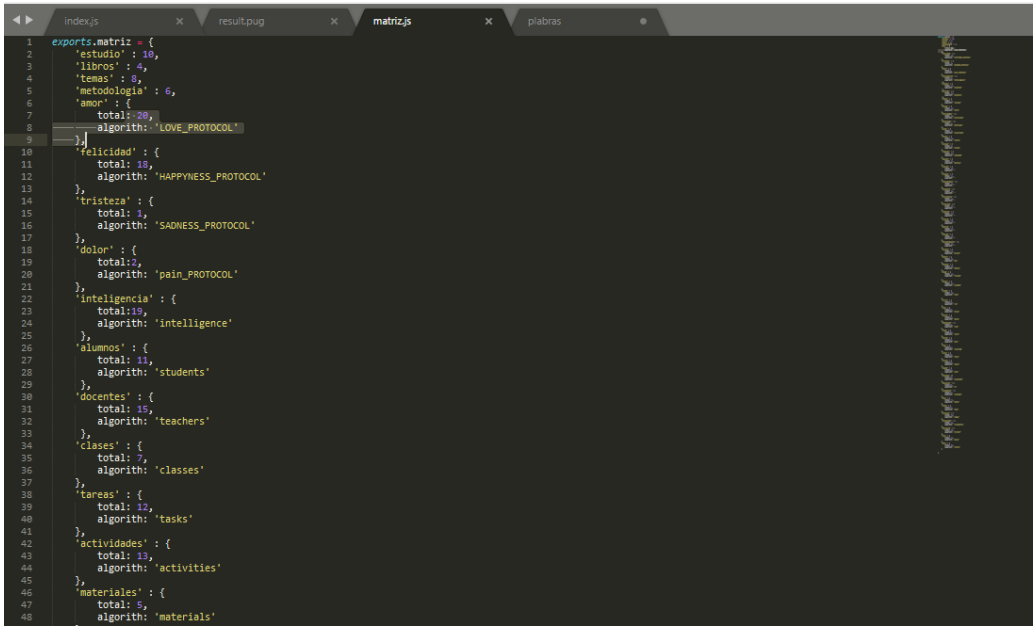



**Fig N°11** (Matrix with weighting)

Each protocol has its own internal CARINA pattern and it would automatically fill such protocols are sent basically through a console, the frontend of the created prototype has a box of this (see figure N °12), for

this example it will be entered in a paragraph that will include some of the words that were previously entered in the matrix that was created.


**Fig N°12** (Front End Prototype of FOF Software)

When sending this information, FOF software will trigger the protocol that was previously assigned to each of the words that you found known in the text, and order them according to the weight assigned to it. (See figure N°13) will only show a result per word that indicates its knowledge of it, but not the information it have about it.

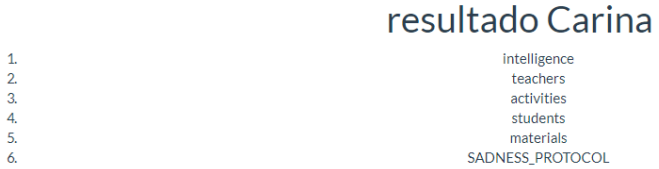



**Fig N°13 (**Result Of FOF software)

One of the tests carried out on FOF software was to measure the time it took to recognize among a set of words those that were familiar, that is to say that they were stored. First a test was carried out with 2 words (see Fig. N°14) then with 6 words (see Fig. N°15.) And finally with 15 (see Fig. N°16.). These times are shown in the console.

```
]
[
  { total: 2, algorith: 'pain_PROTOCOL' },
  { total: 1, algorith: 'SADNESS_PROTOCOL' }
]
[
  { task: 'pain_PROTOCOL', time: 1563336981677 },
  { task: 'SADNESS_PROTOCOL', time: 1563336981677 }
]
1563336981677
```

**Fig N°14** (Test With 2 Words)

```
]
[
  { total: 19, algorith: 'intelligence' },
  { total: 15, algorith: 'teachers' },
  { total: 13, algorith: 'activities' },
  { total: 11, algorith: 'students' },
  { total: 5, algorith: 'materials' },
  { total: 1, algorith: 'SADNESS_PROTOCOL' }
]
[
  { task: 'intelligence', time: 1563336357004 },
  { task: 'teachers', time: 1563336357004 },
  { task: 'activities', time: 1563336357004 },
  { task: 'students', time: 1563336357004 },
  { task: 'materials', time: 1563336357004 },
  { task: 'SADNESS_PROTOCOL', time: 1563336357004 }
]
1563336357004
```

**Fig N°15** (Test With 6 Words)

```
npm
  { total: 34, algorith: 'man' },
  { total: 30, algorith: 'food' }
]
[
  { total: 34, algorith: 'man' },
  { total: 33, algorith: '' },
  { total: 33, algorith: 'person' },
  { total: 30, algorith: '' },
  { total: 30, algorith: 'food' },
  { total: 29, algorith: '' },
  { total: 23, algorith: '' },
  { total: 19, algorith: 'intelligence' },
  { total: 15, algorith: 'teachers' },
  { total: 13, algorith: 'activities' },
  { total: 13, algorith: 'activities' },
  { total: 11, algorith: 'students' },
  { total: 5, algorith: 'materials' },
  { total: 5, algorith: 'materials' },
  { total: 2, algorith: 'pain_PROTOCOL' },
  { total: 1, algorith: 'SADNESS_PROTOCOL' }
]
[
  { task: 'man', time: 1563336758018 },
  { task: '', time: 1563336758018 },
  { task: 'person', time: 1563336758018 },
  { task: '', time: 1563336758018 },
  { task: 'food', time: 1563336758018 },
  { task: '', time: 1563336758018 },
  { task: '', time: 1563336758018 },
  { task: 'intelligence', time: 1563336758018 },
  { task: 'teachers', time: 1563336758018 },
  { task: 'activities', time: 1563336758018 },
  { task: 'activities', time: 1563336758018 },
  { task: 'students', time: 1563336758018 },
  { task: 'materials', time: 1563336758018 },
  { task: 'materials', time: 1563336758018 },
  { task: 'pain_PROTOCOL', time: 1563336758018 },
  { task: 'SADNESS_PROTOCOL', time: 1563336758018 }
]
1563336758018
```

**Fig N°16** (Test With 15 Words)

Knowing the time to throw and center the milliseconds of the difference found in each of the 3 examples, you can find in the number of words, it can say, at the time of the familiarity activity. It's highlighted that the desire to continue doing more tests with much larger numbers of words and more specifically the conclusion we have had for this test.

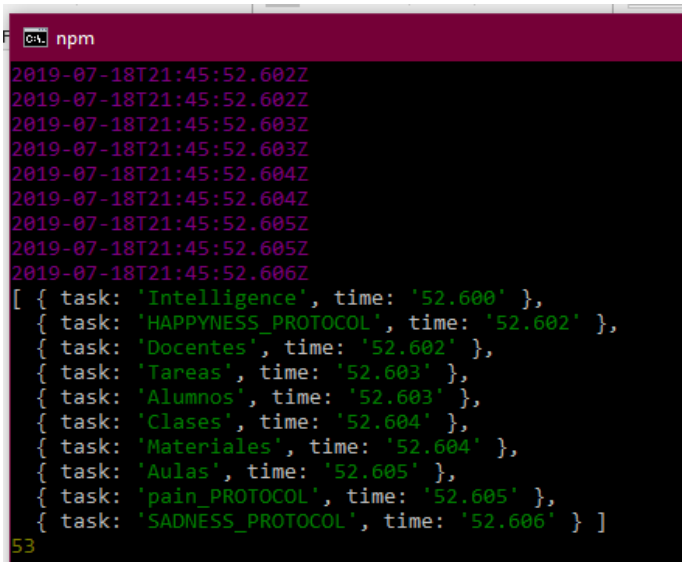



**Fig N°17** ( Test with 10 words)

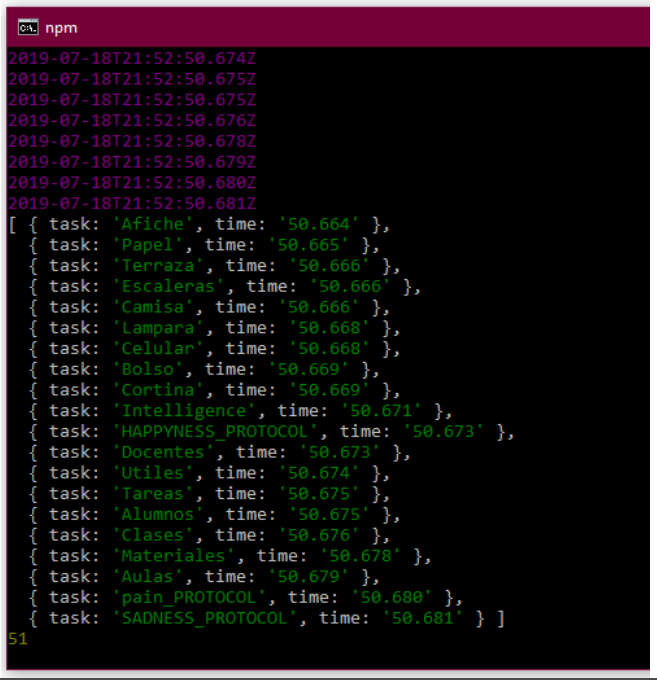


**Fig N°18**( Test with 20 words)

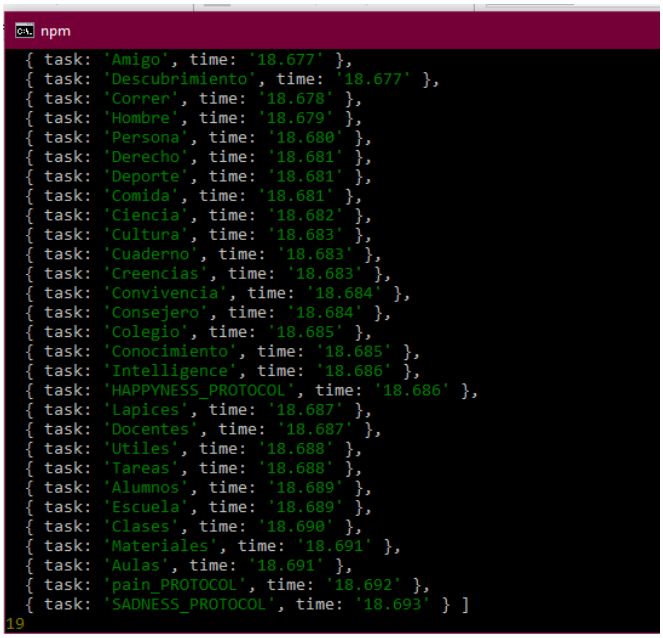



**Fig N°19** ( Test with 40 words)

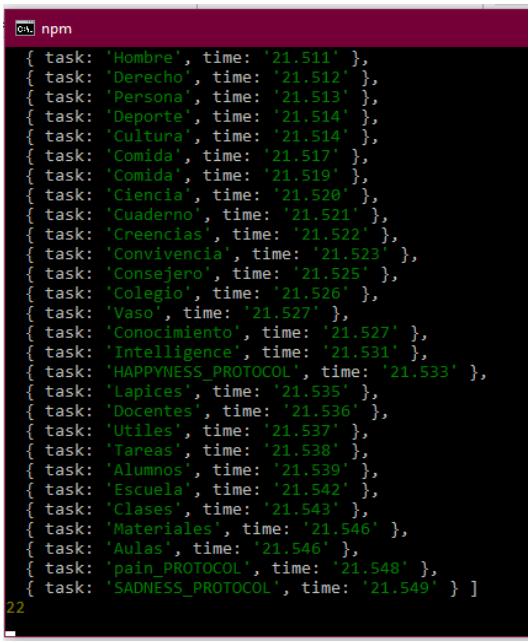



**Fig N°20** ( test with 60 words)

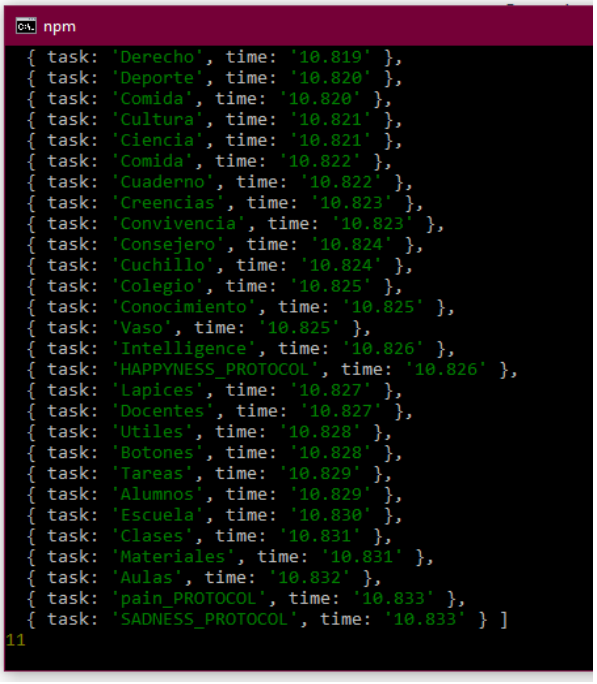



**Fig N°21** (Test with 80 words)

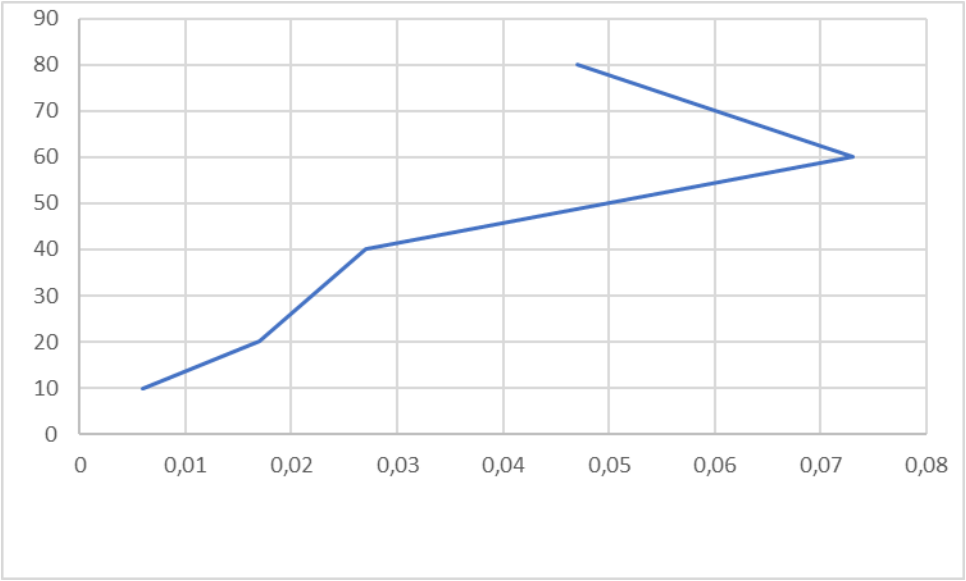



**Fig N°22**

**Example # 1**

Graph number 1 have different behaviors by intervals. In the first interval from 10 to 20 it is still a straight

line of positive slope and the function is increasing, in that range the number of words increases and also the time it takes to search for them, from 20 to 40 it still has the same behavior of straight line with positive slope but in this case the inclination is greater, indicating that the words are being searched in less time than the previous ones, from 40 to 60 the inclination is less taking longer to identify the words, finally from 60 to 80 the function changes and the slope is negative decreasing the number of time to greater number of words

In this graphic are shown the results of the test in which the execution time of the FOF software was verified, a list of familiar words was included in the text box of the prototype, the test was made taking into account the result of the time depending on the number of words (10, 20, 40, 60, 80):

10 words: 0.006
20 words: 0.017
40 words: 0.027
60 words: 0.073
80 words: 0.047

With the obtained result, it can be observed that from the 10 words to the 60 words the response time was ascending, therefore, the greater the number of words, the greater the time of execution of a FOF, in the graph it is also observed that enter 80 words the execution time of a FOF decreases.

**Example # 2**

"Cases of drug micro-trafficking, they make me feel Happiness robbery Coexistence Beliefs in broad daylight and all were put to selective killings have had a noticeable increase in the months, especially in the southern neighborhoods and the commercial sector bringing complaints to the councilors that, from their function of political control, they made proposals as a solution to stop the councilman Carlos Zapata, the initiative of which in specific with greater criminal printer is carried out the surveillance with delivering the materials For the political leader is to contemplate investments of the municipality with this type of technology that would help delinquents when it is called the "fugitive capture plan"


**Fig N°23** ( Test with 5 words in a paragraph)

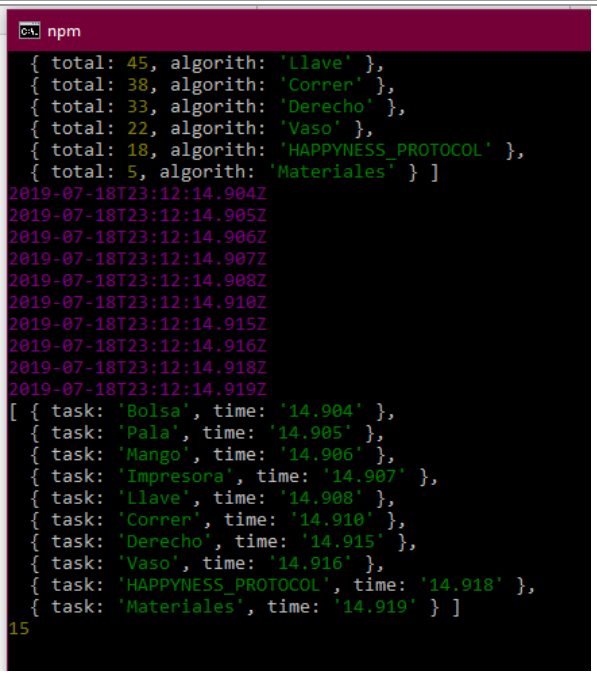



**Fig N°24** (Test with 10 words in a paragraph)

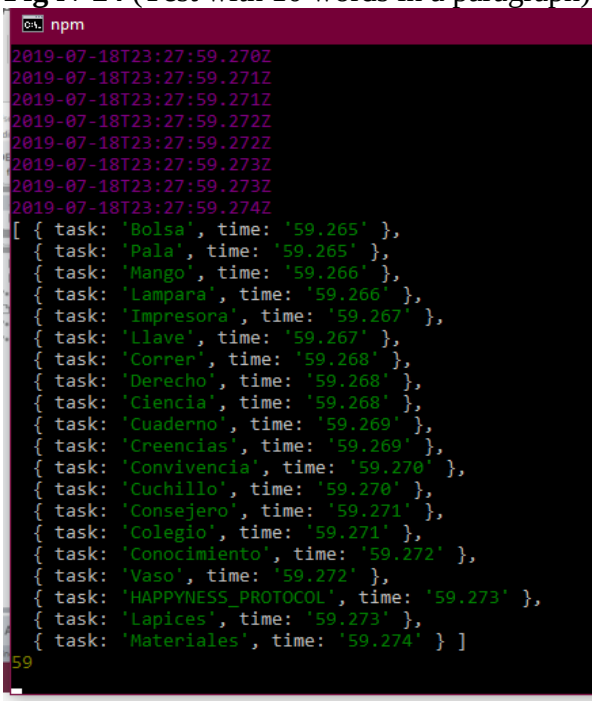



**Fig N°25** (Test with 20 words in a paragraph)

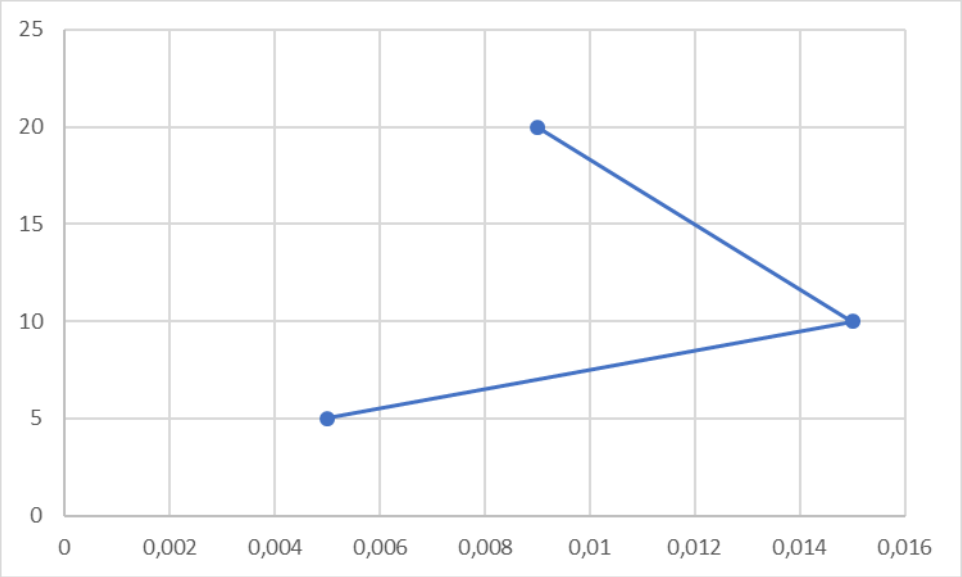



**Fig N°26**

Graph number 2 continues to have different behaviors by intervals. In the first interval of 5 to 10 it remains a straight line of positive slope with an increasing function, for the case of 20 it also remains a straight line but the function decreases
for this graph, a paragraph was used with 113 words of which a certain number were known (5, 10, 20) obtaining the following results

5 words: 0.005
10 words: 0.015
20 words: 0.009

An equality was found with the example # 1 where the last result of the time obtained with 20 words decreased with little difference.

**Example # 3**

```
  { task: 'SADNESS_PROTOCOL', time: '56.28' },
  { task: 'SADNESS_PROTOCOL', time: '56.29' },
  { task: 'SADNESS_PROTOCOL', time: '56.29' } ]
56
[ { total: 18, algorith: 'HAPPYNESS_PROTOCOL' },
  { total: 18, algorith: 'HAPPYNESS_PROTOCOL' },
  { total: 45, algorith: 'Llave' },
  { total: 45, algorith: 'Llave' },
  { total: 2, algorith: 'pain_PROTOCOL' },
  { total: 2, algorith: 'pain_PROTOCOL' } ]
[ { total: 45, algorith: 'Llave' },
  { total: 45, algorith: 'Llave' },
  { total: 18, algorith: 'HAPPYNESS_PROTOCOL' },
  { total: 18, algorith: 'HAPPYNESS_PROTOCOL' },
  { total: 2, algorith: 'pain_PROTOCOL' },
  { total: 2, algorith: 'pain_PROTOCOL' } ]
2019-07-19T14:16:30.468Z
2019-07-19T14:16:30.470Z
2019-07-19T14:16:30.471Z
2019-07-19T14:16:30.474Z
2019-07-19T14:16:30.476Z
2019-07-19T14:16:30.477Z
[ { task: 'Llave', time: '30.468' },
  { task: 'Llave', time: '30.470' },
  { task: 'HAPPYNESS_PROTOCOL', time: '30.471' },
  { task: 'HAPPYNESS_PROTOCOL', time: '30.474' },
  { task: 'pain_PROTOCOL', time: '30.476' },
  { task: 'pain_PROTOCOL', time: '30.477' } ]
30
```

**Fig. N°27** (Example with repeated words within a text)

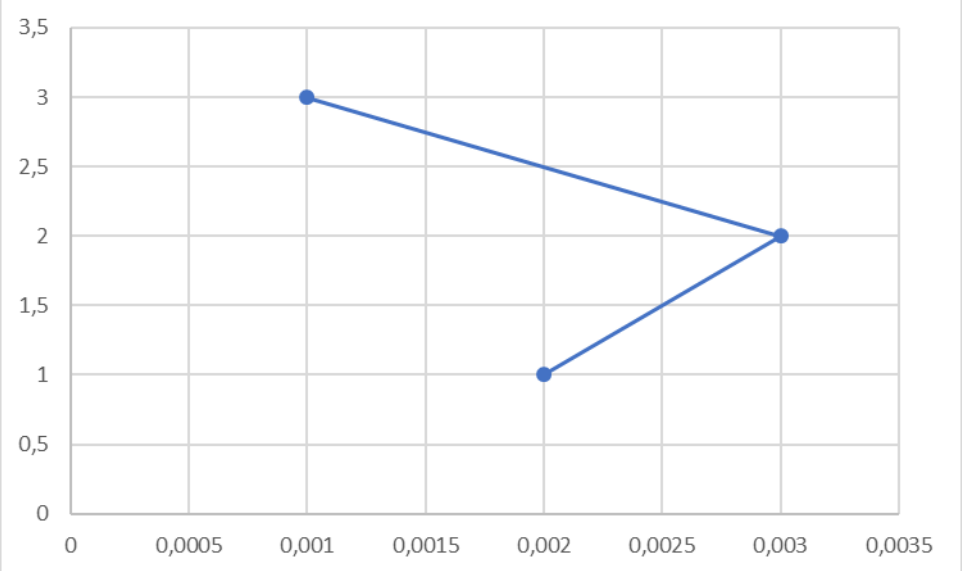



**Fig N°28**

In graph number 3, like the previous ones, the behavior is different by intervals, it is observed that the first two words (key, happiness) repeated in a text are shown in a straight line of positive slope being increasing, but in the case of the last word (pain) the slope is negative given a decrease in time, this time of execution of

a fof was validated taking into account a paragraph with 99 words, three of them are familiar with the FOF software. These three words were repeated throughout the text, giving the following results.

key: 0.002
happiness: 0.003
pain: 0.001

**Below is the text used to perform this test**

*"The British returned to the United Kingdom in 1973, with Felicidad Felicidad where he finished his education before working in Scandinavia and the Middle East as an English teacher. In 2018, a family in Perth found the oldest message in the world in a bottle, with a Key Wrench almost 132 years after it was thrown into the sea. Australian experts confirmed that the note, dated June 12, 1886, had been dropped from the German ship with much pain Dolor Paula as part of an experiment on ocean routes and navigation by the German Naval Observatory"*

Finally, for the design of the prototype the Xpress tool was used which depends on a server, Xpres was used to show how it would be in real time the processing within some own application, it has a cache memory of the browser, when sending repeated requests the information is stored in the cache memory, it is necessary to connect to the internet because Xpress has components that need to make service requests for being a web server. The requests that are made needs to be compared with a server of property to compare the functions and send the respective answers.

The prototype is divided into two fundamental parts called: frontend and backend.

**Frontend:** which is not functional, it simply renders a simple view through a Node template engine. Js that allows the user to see what is happening through the backend, since through the sending of data a response is received that is reflected in the previously created view.

**Backend:** there is the logic of the prototype, the functions that are being used in the application and how each one runs.

## DISCUSSIONS

In the current investigation, a software prototype was performed for the representation of a metacognitive judgment denominaded Feeling Of Familiarity (FOF) according to (Torres Moraga, E, 2019) People do not have direct access to memory records, but their metacognitive judgments are based on several keys available in the software The prototype that was made, the keys mentioned above, come from the stimuli that enter in this case with a paragraph that contains familiar words and these are stored in a previously made matrix.

Familiarity is related to the understanding that a person has of a certain entity, which is based on their previous interactions and experiences. (Gefen et al., 2003), taking into account this theory the FOF software, having a matrix with words included, these would act as previous experiences, when executing the software a function, in this case looking for a familiar word. I would be checking the degree of knowledge that you have according to the information you perceive.

On the other hand, familiarity plays an important role in the way an individual judges new people or situations. In the event that one situation is more familiar than another, the individual will perceive less complexity and uncertainty (Luhmann, 1989), according to this author it was observed in the results of the

times that the greater the number of words the less time is execution, this is because the FOF software, for its operation has a server that contains a cache memory that stores the familiar words and when entering those same words, the execution time is reduced by activating the FOF .

## CONCLUSIONES

Enuncie las conclusiones alcanzadas con los resultados de la ejecución del proyecto.

In the present paper was presented the formal and semantic representation of a feeling of familiarity (FOF) in the metacognitive architecture of CARINA. A FOF in CARINA is a metacognitive judgment whose purpose is to evaluate the degree of knowledge of the cognitive agent on the information that comes from a stimulus; a trial is a basic element included in the Metacore category of the MISM Metamodel. Perceptual behaviors of the cognitive function consisting of objectives (γ), mental states (σ) and actions (α) were included.

Formally, in carina, a FOF is a production rule that is represented semantically through belief, taking into account the headings of the reasoning traces, which have the IP and OP fields corresponding to the input and output of the cognitive function. Also, the semantic representation of the traces of reasoning and the semantic representation of a belief that is composed of the IS A and HAS fields was presented.

a prototype of software (FOF) was made which as previously mentioned is based on a matrix with words, previously saved with their respective total value and algorithm which triggers a protocol depending on whether the word is entered through the text box is familiar, therefore an experiment was performed with a certain amount of words that were stored in the matrix, observing if the sentiment of familiary is triggered, this result gives a protocol for each recognized word, and the time it is executed.

in CARINA so that the fof goes off, an index of the semantic memory must be taken into account, which will allow the recognition function to have a quick access to the memory and observe the information it contains, to analyze if said information is entered is familiar or not otherwise would be a novelty.

As a result of the examples made and plotted, it was obtained that in its highest percentage for the activation of a FOF the execution time with respect to the number of words always occurs in an ascending order in which a greater number of words greater number of time respect to the validation and activation of familiarity, we found several variations in the time, for the explanation of these cases we can say that it can occur due to the process done by the machine itself and the execution in the search of the words accompanied by a variable (connectivity) taking into account that when making a request to the server it will need an internet connection to generate the answers and it is here where the variation would be presented.

Taking into account the results obtained from the FOF software tests, the feeling of familiarity is a first element for the creation of an algorithm to learn by habituation, that consists in reducing the response, by perceiving a stimulus, which is repeated frequently in a short period of time, making us stop being impressed by receiving stimuli with which we are already familiar (Oviedo, Gilberto., Leonardo.(2004)). This must be programmed and not use the browsers' cache memory for its operation, it must be fully controllable.

Science indicates that in the case of using the web service, you should know the functions that it performs and that the more familiar words are included the faster the FOF will be activated, This is a very good

quality if what is desired is that in CARINA or in any intelligent architecture, the response time becomes more efficient and it takes less time to know that something is familiar.

## RECOMENDACIONES

Formule las recomendaciones surgidas de la ejecución del proyecto.

taking into account the researches carried out, the ports and the results obtained from this research, we propose as a main recommendation that; If you want to have complete control when designing and developing an FOF in a metacognitive architecture, the best alternative to do so is not to use Web Service, instead use a framework that allows the entire experimentation environment to be fully controllable.

In addition, it is recommended that current research be taken as the beginning for the development of a learning algorithm by habit. Likewise, if it is desired to continue with the development of other metacognitive judgments such as FOK, this study will be taken as the basis for close research.

## BIBLIOGRAFÍA

Liste en orden alfabético las referencias bibliográficas consultadas en la elaboración del informe del proyecto.

Alva, Noe.(2004) *Action in perception. MIT press*

Abud Figueroa, A. (2009). *Metodología de Ingeniería de Software Educativo*

Antonio, J., & Requena, G. De.(2010)*Para una reconstrucción genealógica y epistemológica del concepto de metacognición, XVIX, 129–153.*

Bajšanski, Igor., and Maja. Močibob. ( 2014) *Metacognitive Judgments and Syllogistic Reasoning ognitive Judgments and Syllogistic Reasoning, April.*

Caro, Manuel. F., Darsana. P., Josvula. Adan. A. Gomez, and Catriona. M. Kennedy.(2018) *luction to the CARINA Metacognitive Architecture." Proceedings of IEEE 17th ational Conference on Cognitive Informatics and Cognitive Computing, ICCI*CC , no.October: 530–40.*

Crowder, J. A., & Friess, S.(July 2011)*Metacognition and Metamemory Concepts for AI Systems Meta-cognition and Metamemory Concepts for AI Systems 1 Introduction* : Artificial Cognition

Caro, Manuel. F.(2015). *Metamodel for personalized adaptation of pedagogical strategies using ognition in Intelligent Tutoring Systems. Diss. Universidad Nacional de Colombia-Sede*

Caro, Manuel F., Adán A. Gómez., and Juan C. Giraldo.,(2017) *Algorithmic knowledge profiles for introspective monitoring in artificial cognitive agents*. 2017 IEEE 16th International Conference on Cognitive Informatics & Cognitive Computing (ICCI* CC). IEEE,

Cox, Michael. T., and Ashwin. Ram.(1999)*Introspective multistrategy learning: On the con-*
*on of learning strategies.* Artificial Intelligence.

Caro, M.F., Josyula, D.P., Cox, M.T., Jiménez, J.A.(2014) *Design and validation of a Metamodel for metacognition support in artificial intelligent systems. Biologically Inspired Cognitive Architectures*. 9, 82–104.

Cox, M.T., Raja, A.(2012) *Metareasoning: An introduction. MIT Press, Cambridge, MA.*

*Cox, M.T.(2005) Metacognition in computation*: A selected research review. Artificial intelligence. 169, 104–141.

Cox, M. T., Oates, T., Perlis, D.(2011) *Toward an Integrated Metacognitive Architecture. In AAAI Fall Symposium: Advances in Cognitive Systems.*

Caro, M., D. Josyula., and J. Jimenez.(2013) *Metamemory for information retrieval from long-term memory in artificial cognitive systems.* Annual Conference on Advances in Cognitive Systems: Workshop on Metacognition in Situated Agents.

Cosacov, Eduardo., n.d. *Introducción a La Psicología.*

Dienes, Zoltan., Ryan. B. Scott., and Lulu. Wan.: *Implicit Learning,* 51–52.

Efklides. A.(2002) *The systemic nature of metacognitive experiences* Metacognition 19-34. doi: 10.1007 / 978-1-4615-1099-4_2.

Estudio, A L, D E L A Percepci, and Enfoque Computacional. n.d.: Percepción, Atención y Memoria," 1–23.

Endel, Tulving., Henry. L. (2011)*Roediger Varieties of Memory and Consciousness* Essays in Honour of Endel Tulving. Psychology Press

Flórez, M., Gómez, A., & Caro, M. (2018). *Cognitive Function Perception In CARINA*

France, I. U. De.(2010)*Judging familiarity and emotion from* 17(3), 335–341.

Fodor, J.A.(1975) *The language of thought New York*

Gracián, Triviño. Barros. ( 2000)*Un modelo de Arquitectura Cognitiva Aplicación en Robótica Móvil*

Haro, Mediavilla., Mendez, Maigua.(2010) *Universidad Técnica Del Norte Facultad de Educacion.*

*Ciencia y Tecnologia.*

*Illusions of immediate memory* (2004) evidence of an attributive basis for feelings of familiarity and perceptual quality. In: Journal of Memory andLanguage.

Irene, Adriana., and Hernandez. Gomez., n.d. "*Procesos Psicológicos Básicos*

Jacoby, Lawrence. L., Colleen. M.; Kelley, and Jane. Dywan.(1989) *Memory attributions."Varieties of memory and consciousness* Essays in honour of Endel Tulving.

Koriei, Asher. Ravit. Nussirison. Herbert. Bless. and Nira. Shaked. (2005) *"Based MetacognitiveJudgments : Evidence from Subjective Confidence."*

Kronlund, Antonia, Bruce, W. A. Whittlesea, and Carolyn,Yoon.(2007) *And Familiarity,*

Michael, T. Cox., Michael. Maynord., Tim. Oates.(2013)et al The Integration of Cognitive and Metacognitive Processes with Data-driven and Knowledge-rich Structures.

Miguel, Madrid.(2011) *Arquitecturas Cognitivas y Cerebro"*, Hacia Una Teoría Unificada de La Cognición Cognitive Architectures and Brain : Towards an Unified Theory of Cognition.International Journal of Psychological Research.

Mike, Oaksford. Nick. Chater.(2010) *Cognition and Conditionals*, Probability and Logic in Human Thinking. Oxford University Press.

Mole, Callum. D., Radka. Jersakova., Georgios. K Kountouriotis., Chris J A Moulin., and Piccinini, G.(2010)*The Mind as Neural Software Understanding Functionalism, Computational- ism, and Computational Functionalism. SSRN Electronic Journal.*

Nalepa, Grzegorz J.(2016) *Diversidad de enfoques basados en reglas: sistemas clásicos y aplicacio-nes recientes.*

Oviedo, Gilberto., Leonardo.(2004) *Palabras Clave : Abstract : Key Words : Antecedentes y Contexto Histórico Del Cocepto Percepción*, no. 18: 89–96.

Periáñez Morales, J. (2019). Fundamentos del aprendizaje y del lenguaje [Ebook] (p. 32). Editorial UOC, 2012.Retrievedfrom https://books.google.com.co/books?hl=es&lr=&id=0WqpFcXiYxMC&oi=fnd&pg=PA11&dq=habituacion+aprendizaje&ots=xRYMzmzXb

Richard M Wilkie. (2018) *"Metacognitive Judgements of Perceptual-Motor Steering Performance.*

Rosenthal, David. M.(2000) *"Consciousness , Content , and Metacognitive Judgments"* 214: 203–

Ron, Sun (ed).(2006) *Cognition and Multi-Agent Interaction: From Cognitive Modeling to Social Simulation. Cambridge University Press.*

Scheutz, M.(2001) *Computational versus causal complexity* Minds and Machines.

Torres Moraga, E. (2019*). Analysis of the relationship between familiarity, perceived security and trust towards internet banking* [Ebook]. Venezuela.

Whittlesea, B. W. A., & Williams, L. D. (2000) *The Source of Feelings of Familiarity* : The Discrepancy-Attribution Hypothesis, 26(3).

Whittlesea, B. W. A., & Williams, L. D.(2001) *The Discrepancy-Attribution Hypothesis : II . Expectation , Uncertainty , Surprise , and Feelings of Familiarity*

**PRODUCTOS**

Relacione cada uno de los productos que se comprometió a entregar con la ejecución del proyecto, el indicador y los impactos de dicho mejoramiento para la Universidad, la región y/o el país.

| PRODUCTO OBTENIDO | INDICADOR | BENEFICIARIO | IMPACTO DEL PRODUCTO | TIEMPO ESTIMADO DEL IMPACTO |
|---|---|---|---|---|
| 2 estudiantes graduadas. | Actas de graduación. ( 1 por estudiante) | Universidad De Córdoba | Regional-Nacional | 12 Meses |
| Publicación de artículo en revista no indexada nacional. | Publicación del articulo | Universidad De Córdoba | Nacional | 15 meses |
| Presentación en evento nacional – workshop. | Memorias del evento. | Universidad De Córdoba | Nacional | 12 meses |
| Prototipo de software. | Prototipo de software FOF funcional. | Universidad De Córdoba | Nacional e internacional | 12 meses |

# ANEXOS

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para mí

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Dear Ana Maria,

We are glad to notify you that your paper "Formal Representation of Feeling of Familiarity as a Metacognitive Judgement in Metacognitive Architecture CARINA" has been **accepted subject to revision** for oral presentation and publication the ICAETT 2019 proceedings that will be published in Springer through their Advances in Intelligent Systems and Computing series, and submitted for indexing to ISI Proceedings, EI-Compendex, DBLP, SCOPUS, Google Scholar and Springer link.

***We strongly recommend you consider and follow all the suggestions given by the reviewers. ***

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2. We strongly recommend reviewing the English of the paper by a native speaker.

ICAETT 2019 - Program Recibidos ×

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Dear Ana Maria Murillo,

In the attached please find the updated version of ICAETT 2019 program.

Kind Regards,

ICAETT 2019 PC.

| | UNIVERSIDAD DE CÓRDOBA | CÓDIGO: FDOC - 082<br>VERSIÓN: 01<br>EMISIÓN: 19/05/2016<br>PÁGINA 1 de 2 |
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| | SOLICITUD DE MOVILIDAD | |

| CÓDIGO DE REGISTRO | |
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| NOMBRE DEL SOLICITANTE | NÚMERO DE IDENTIFICACIÓN | TIPO DE VINCULACIÓN | | | | FACULTAD/ DEPARTAMENTO |
|---|---|---|---|---|---|---|
| Karin Julisa Mestra Aguilera | c.c. 1067953897 | Estudiante | x | Docente | | Educación- Departamento de Informática Educativa |

| NOMBRE DEL EVENTO/ACTIVIDAD |
|---|
| 1er Congreso Internacional sobre Avances en Nuevas Tendencias y Tecnologías (ICAETT 2019) |

| TIPO DE EVENTO/ACTIVIDAD | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Congreso | x | Conferencia | | Simposio | | Coloquio | | Pasantía | | Curso | | Otro | |

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|---|---|---|---|---|---|---|---|---|---|
| Regional | | Nacional | | Internacional | x | Quito, Ecuador | Universidad Tecnológica Israel situada en Quito, Ecuador | 29/Mayo/2019 | 31/Mayo/2019 |

| GRUPO DE INVESTIGACIÓN O SEMILLERO | CATEGORÍA DEL GRUPO | CLASIFICACIÓN DEL INVESTIGADOR |
|---|---|---|
| Cognitive Informatics and Cognitive Computing | C | Estudiante de pregrado |

| TÍTULO DEL TRABAJO/ACTIVIDAD |
|---|
| Formal Representation of Feeling of Familiarity as a Metacognitive Judgement in Metacognitive Architecture CARINA |

| TIPO DE TRABAJO | | | | | | | |
|---|---|---|---|---|---|---|---|
| Póster | | Ponencia | x | Conferencia magistral | | Curso | Otro |

| RESUMEN DEL TRABAJO/ACTIVIDAD |
|---|
| *Abstract*—The Feeling of Familiarity (FOF) is a metacognitive judgment whose activation occurs when perceiving a stimulus coming from the environment, in the current research is presented the formal and semantic representation of a FOF in metacognitive architecture CARINA. A FOF is presented as a production rule, which has the following fields; condition, assert, strategy, next and else. Also, is presented the formal and semantic representation of a reasoning trace and the semantic representation of a belief in CARINA'S metacognitive architecture. |

| INFORMACIÓN DE OTROS AUTORES O PARTICIPANTES VINCULADOS A LA INSTITUCIÓN | | | | |
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| Karin Julisa Mestra Aguilera | C.C. 1.067.953.897 | ponente | 3008016098 | Karinaguilera23@gmail.com |
| Ana Maria Murillo Mestra | C.C. 1.233.341.704 | Ponente | 3206142086 | anamurillomestra@gmail.com |
| Adán Alberto Gómez Salgado | C.C 11003536 | Autor | 3003240343 | aagomez@correo.unicordoba.edu.co |

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**Botto Tobar, M.A.** <M.A.Botto.Tobar@tue.nl> sáb., 11 may. 07:15

para mí

Estimada Karin Julisa Mestra Aguilera,

Nos complace comunicarle que ha sido seleccionada como Student Volunteer para ICAETT 2019.

Nos vemos en Quito el 27 de Mayo.

Saludos Cordiales/Kind Regards,

Miguel Botto Tobar
Eindhoven University of Technology
MF 6.083
Den Dolech 2 5612 AZ
Eindhoven, The Netherlands
https://research.tue.nl/en/persons/miguel-botto-tobar
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**Paper Id:** ICAETT 2019 - 83
**Tittle:** Formal Representation of Feeling of Familiarity as a Metacognitive Judgement in Metacognitive Architecture CARINA
**Authors:** Karin Julisa Mestra, Ana María Murillo, Adan Alberto Gómez, and Manuel Fernando Caro

Dear Authors,

We are glad to notify you that your paper entailed above has been **accepted subject to revision** for oral presentation and publication the ICAETT 2019 proceedings that will be published in Springer through their Advances in Intelligent Systems and Computing series, and submitted for indexing to ISI Proceedings, EI-Compendex, DBLP, SCOPUS, Google Scholar and Springer link.

***We strongly recommend you consider and follow all the suggestions given by the reviewers.***

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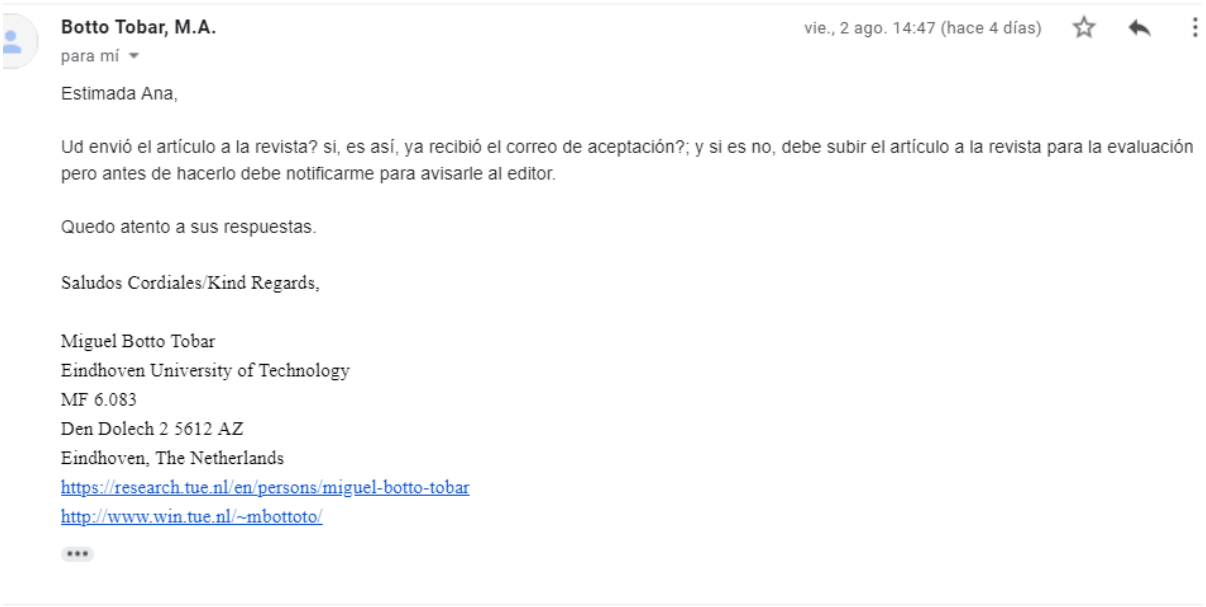

**Botto Tobar, M.A.** vie., 2 ago. 14:47 (hace 4 días)

para mí

Estimada Ana,

Ud envió el artículo a la revista? si, es así, ya recibió el correo de aceptación?; y si es no, debe subir el artículo a la revista para la evaluación pero antes de hacerlo debe notificarme para avisarle al editor.

Quedo atento a sus respuestas.

Saludos Cordiales/Kind Regards,

Miguel Botto Tobar
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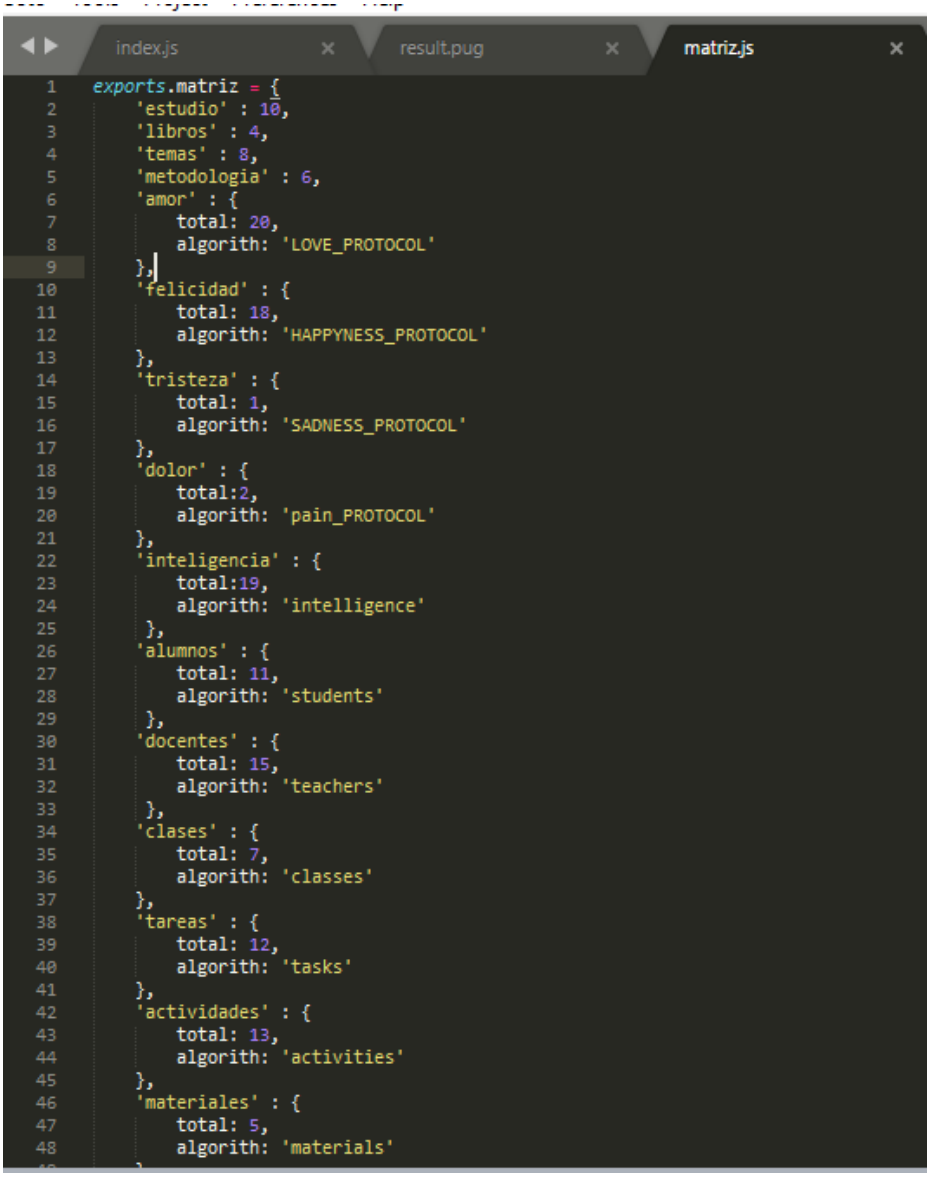
**Importan**

We are currently in conversation for the publication of the article previously reviewed by international peers and approved in a journal


index.js
result.pug
matriz.js
exports.matriz = {
'estudio' : 10,
'libros' : 4,
'temas' : 8,
'metodologia' : 6,
'amor' : {
total: 20,
algorith: 'LOVE_PROTOCOL'
},
'felicidad' : {
total: 18,
algorith: 'HAPPYNESS_PROTOCOL'
},
'tristeza' : {
total: 1,
algorith: 'SADNESS_PROTOCOL'
},
'dolor' : {
total:2,
algorith: 'pain_PROTOCOL'
},
'inteligencia' : {
total:19,
algorith: 'intelligence'
},
'alumnos' : {
total: 11,
algorith: 'students'
},
'docentes' : {
total: 15,
algorith: 'teachers'
},
'clases' : {
total: 7,
algorith: 'classes'
},
'tareas' : {
total: 12,
algorith: 'tasks'
},
'actividades' : {
total: 13,
algorith: 'activities'
},
'materiales' : {
total: 5,
algorith: 'materials'

index.js | result.pug | matriz.js

```
    },
    'aulas' : {
        total: 3,
        algorith: 'classrooms'
    },
    'utiles' : {
        total: 14,
        algorith: 'useful'
    },
    'escuela' : {
        total: 9,
        algorith: 'school'
    },
    'cuaderno' : {
        total: 16,
        algorith: 'notebook'
    },
    'lapices' : {
        total: 17,
        algorith: 'pencils'
    },
    'ciencia' : {
        total: 30,
        algorith: ''
    },
    'colegio' : {
        total: 23,
        algorith: ''
    },
    'conocimiento' : {
        total: 22,
        algorith: ''
    },
    'consejero' : {
        total: 24,
        algorith: ''
    },
    'convivencia' : {
        total: 26,
        algorith: ''
    },
    'creencias' : {
        total: 28,
        algorith: ''
    },
    'cuaderno' : {
        total: 29,
        algorith: ''
```

index.js | result.pug | matriz.js

```
var express = require('express');
var bodyParser = require("body-parser");
var cors = require('cors');
var app = express();


app.set('view engine', 'pug');

/**bodyParser.json(options)
 * Parses the text as JSON and exposes the resulting object on req.body.
 */
app.use(bodyParser.urlencoded({ extended: false }));
app.use(bodyParser.json());

app.use(cors());

app.get('/', function (req, res) {
  res.render('index');
});

app.post('/', async function(req, res) {

    let recongized = []

    let runTask = []

    let { matriz } = require("./data/matriz");

    let text = req.body.text;


    //function compara input client #perception  to matriz
    text.split(" ").forEach(function(word) {

        if(matriz[word] != undefined){

            recongized.push(matriz[word]);

        }

    });

    console.log(recongized);

    function compareValues(key, order='asc') {
      return function(a, b) {
        if(!a.hasOwnProperty(key) ||
           !b.hasOwnProperty(key)) {
```

```
index.js | result.pug | matriz.js

49          return 0;
50        }
51
52        const varA = (typeof a[key] === 'string') ?
53          a[key].toUpperCase() : a[key];
54        const varB = (typeof b[key] === 'string') ?
55          b[key].toUpperCase() : b[key];
56
57        let comparison = 0;
58        if (varA > varB) {
59          comparison = 1;
60        } else if (varA < varB) {
61          comparison = -1;
62        }
63        return (
64          (order == 'desc') ?
65          (comparison * -1) : comparison
66        );
67      };
68    }
69
70    // ordena el arreglo de reconocido por el total de mayor a menor
71    const ListOfProcess = recongized.sort(compareValues('total', 'desc'));
72
73    console.log(ListOfProcess);
74
75    // ejecuta las funciones con el tiempo de ejecucion
76    ListOfProcess.map(task => {
77        runTask.push({ task: task.algorith, time: Date.now() });
78    })
79
80    console.log(runTask);
81
82    totaltime = 0;
83
84    //calcula el tiempo estandar de las funciones ejecutadas
85    runTask.map( (time) => {
86        totaltime += time.time
87    })
88
89    totaltime = totaltime / runTask.length;
90
91    console.log(totaltime);
92
93    /*for (const task of runTask){
94        await task()
95    }*/
96
```