Interrelation Between Working Memory & Consciousness Consequent SLA

Wafaa Metwalli, Misr International University, Egypt

The Paris Conference on Education 2022
Official Conference Proceedings

Abstract
It has been agreed about the general consensus regarding working memory that it is extensively involved in goal-directed behaviors retained and manipulated to ensure successful task execution. The theoretical framework behind working memory including its capacity limit and temporary storage is a multicomponent system that manipulates information stowing for greater and more complex cognitive utility (Baddeley and Hitch, 1974; Baddeley, 1996, 2000b). Consciousness is considered the supreme mental function which forms the highest level of mental activity. Without it, no matter how immensely intelligent humans will be just another kind of robot, existing in this world without having the awareness and experiences of seeing, hearing , touching, feeling or thinking of what it is like to be themselves (C. Uckachok 2018). The target of the research is to investigate the elements of consciousness and their effects on the working memory in SLA. The Module Online Growth and Use of Language (MOGUL[1]), as a framework which provides a basic model of focusing on the language's place in the mind. It can be used as a cross interdisciplinary theoretical framework for investigating how language is acquired, processed and stored in the mind. Moreover it will screen those relative effects of consciousness on the working memory in the SLA process. Excessed knowledge in this field consequence develop in SLA.

Keywords: Consciousness, A State of Attention, Knowledge and Awareness to the Surroundings

iafor
The International Academic Forum
www.iafor.org

[1] Mogul: A system to contribute to language acquisition and its development.

Introduction

Working Memory

Working memory is one of the most widely used terms in psychology? It has often been related to intelligence, information processing, executive function, comprehension, problem-solving, and learning, in people ranging from infancy to old age and in all sorts of animals. Working memory is the retention of a small amount of information in a readily accessible form (Nelson Cowan 2014). The use of working memory (MW) is quite ubiquitous in human thought, but the best way to improve education using what we know about working memory is still controversial. Nelson Cowan (2012), in his investigation for the concept of the working memory in the field of improving learning and education, establishes its key characteristics and boundaries. Cowan suggested that organizing knowledge, reduces one's memory load because the parts don't have to be held in mind independently that is to say, we must learn how to adjust the receptive materials to facilitate learning and education with the working memory abilities that the learner has.

There are two types of memory system: short-term memory (STM) and long-term memory (LTM) system. The information coming from the environment is processed by a series of temporary sensory memory systems and then fed into a limited capacity short-term store (STS). This is assumed to act as a WM—that is, a system for holding information and allowing it to be used to perform a wide range of cognitive tasks, including transfer into, and retrieval from, LTM. Human memory comprises an alliance of separable systems. WM is one of these, providing the temporary storage that underpins the capacity for complex thought. It may be divided into the following: the phonological loop, the visuospatial sketchpad, and the central executive. The phonological loop model assumes that forgetting is a result of simple trace decay within the store. The visuospatial sketchpad is a system that parallels the phonological loop but has proved less easy to study. The central executive is the most important, complex, but least understood component of WM. Individuals differ in the capacity of their various working memory subsystems in ways that influence scholastic achievement. There is a limited capacity on what we can keep in our stores, which can have negative effects on academic performance. Fortunately, there are many ways to enhance this and make the most of this crucial mental faculty through investigating the functions of the memory (Baddeley 2016).

Memory is related to learning but should not be confused with learning. There are three main processes involved in human memory:

- **Encoding**
  Transforming information into a form that can be stored in memory.
- **Storing**
  Maintaining the encoded information in memory.
- **Retrieving**
  Re-accessing information from the past which has been encoded and stored.

Encoding is the first process that the human memory puts in operation. The efficiency of learning, in general, depends on the efficiency of the encoding process. It is an active and selective process that depends on several factors. There are three types of factors that can influence encoding efficiency:

1. **Content factors**
   Related to the type of material to be encoded.
2. **Environmental factors**
   Related to the conditions under which the encoding takes place.
3. **Subjective factors**
   Related to variables in effect when encoding takes place.

The content factors are:

- The volume of the material (the greater the volume, the more difficult the encoding).
- The degree of organization of the material (the better organized, the easier the encoding).
- The degree of familiarity.
- The place occupied by the information in the structure of the content; that is, at the beginning, middle, or end of the material (information placed at the beginning and at the end tends to be stored more easily than that placed in the middle).
- The nature of the material.

If the information is stored, it is permanently transformed, reorganized, and included in new links even if the subject is not fully aware of the process. **Storing** the information involves both quantitative (the duration of retention) and qualitative (the fidelity of retention) aspects.
According to the duration of retention, there are two levels of memory:

- Short-term memory (STM)
- Long-term memory (LTM)

Both acts as filters that protect our brain from the unbelievable amount of information we encounter daily. The more the information is repeated or used, the more likely it is to be retained in long-term memory (which is why, for example, reinforcement of the concepts learned is important when designing a learning program). This is the process of consolidation, the stabilizing of a memory trace after its initial acquisition and it would be clearly witnessed in the retrieving action of the memory.

We have several different memory systems that hold different types of information. For example, *episodic* memory is the store for events in the relatively recent past, such as the birthday party we attended last weekend. *Procedural* memory is memory for skills and habits. We use procedural memory for riding a bike or driving a car. *Semantic* memory is the store of knowledge gained over our lifetime and includes information about word meanings, spellings, and pronunciations (Dehn, 2008).

Consciousness and Learning

Consciousness is considered one of the most controversial issues in applied linguistics concerns the role of conscious and unconscious processes in second language learning. On the one hand, there are many who believe that conscious understanding of the target language system is necessary if learners are to produce correct forms and use them appropriately. In this view, errors are the result of not knowing the rules of the target language, forgetting them, or not paying attention. There is little theoretical support for the most traditional form of this view; no current theory posits the conscious study of grammar as either a necessary or sufficient condition for

language learning. However, Bialystok (1978) has provided a theoretical framework that allows a role for conscious knowledge, and Rutherford and Sharwood Smith (1985) have argued that 'consciousness raising', drawing learners attention to the formal properties of language, facilitates language learning.

According to Schmidth (1990) consciousness is been categorized into three levels,

Level 1: Perception.
It is generally believed that all perception implies mental organization and the ability to create internal representations of external events (Oakley 1985b; Baars 1986). However, perceptions are not necessarily conscious, and subliminal perception is possible.

Level 2: Noticing {focal awareness).
Bowers (1984) points out the crucial distinction between information that is perceived and information that is noticed. When reading, for example, we are normally aware of (notice) the content of what we are reading, rather than the syntactic peculiarities of the writer's style, the style of type in which the text is set, music playing on a radio in the next room, or background noise outside a window. However, we still perceive these competing stimuli and may pay attention to them if we choose.

There are a variety of terms for what is called noticing, including focal awareness (Atkinson and Shiffrin 1968; Kihlstrom 1984), episodic awareness (Allport 1979), and apperceived input (Gass 1988). What these constructs have in common is that they identify the level at which stimuli are subjectively experienced.

When problems of memory and metalanguage can be avoided, verbal reports can be used to both verify and falsify claims concerning the role of noticing in cognition.

Level 3: Understanding.
Noticing is the basic sense in which we commonly say that we are aware of something, but does not exhaust the possibilities. Having noticed some aspect of the environment, we can analyze it and compare it to what we have noticed on other occasions. We can reflect on the objects of

consciousness and attempt to comprehend their significance, and we can experience insight and understanding. All of this mental activity—what we commonly think of as thinking—goes on within consciousness. Problem solving surely represents a continuum (Bialystok and Bouchard Ryan 1985; Karmiloff-Smith 1986). Whatever point on the continuum is considered to differentiate implicit from explicit knowledge will largely determine the extent to which second language knowledge is said to be conscious or unconscious, but a careful reading of the second language literature indicates no consensus on where the line is to be drawn (Odlin 1986).

Whether second language learning is conscious or unconscious it reflects several different contrasts:
(1) Learning is sometimes said to be unconscious when the learner is not aware of having learned something. This is an interesting notion, based on the concept of reflexive self-consciousness, but not one on which there has been much research.

(2) The conscious/unconscious learning contrast may refer to awareness at the level of noticing. In this sense, unconscious learning means 'picking up' stretches of speech without ever noticing them. This is a crucial issue, which should be referred to as the subliminal learning question: is it possible to learn aspects of a second language that are not consciously noticed?
(3) Conscious and unconscious learning may be distinguished on the basis of intention and effort. This is the incidental learning question: if noticing is required, is such noticing automatic or must learners consciously pay attention?
(4) The contrast may also be made with reference to awareness at the level of understanding. In this sense, unconscious learning means the unconscious induction of principles, rules, or algorithms, whereas conscious learning means the establishment of such principles based on insight.
(5) Conscious learning may also be taken to refer to intentions at a more global level, learning according to a deliberate plan involving study and other intentional learning strategies. Unconscious learning, by contrast, may be seen as an unintended by-product of communicative interaction. Of course, such learning might still involve noticing and understanding.
(6) Finally, conscious learning may be referred to the issue of conscious knowledge; can learners say what they appear to 'know'? (Knowledge is represented as the environmental input in the following diagram)

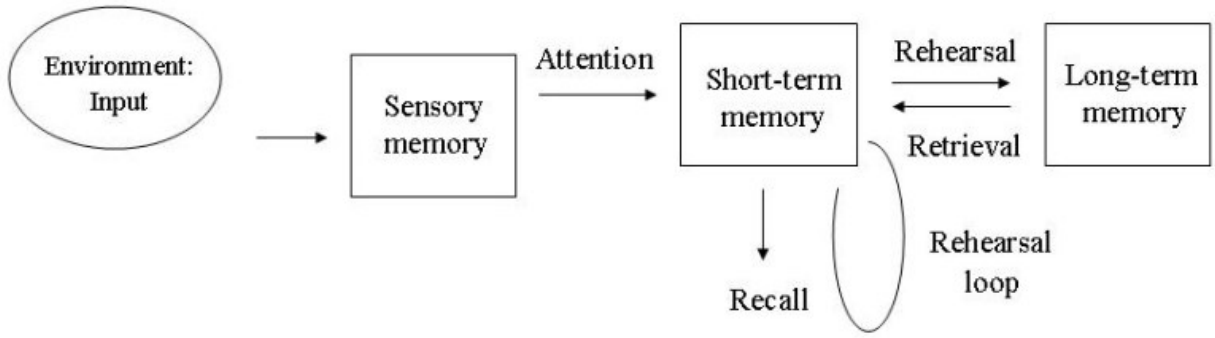

Figure 1: *A diagram of Atkinson and Shiffrin's multi-store model of memory*.

The former diagram of Atkinson and Shiffrin is representing the adjacent relationship of memory and consciousness in contribution to the process of acquisition of a new Language.

The research is trying to state a system to measure the process of acquisition with a framework that is been used for assessing languages' acquisition, which is the MOGUL.

MOGUL Framework

MOGUL stands for Modular On-line Growth and Use of Language (Truscott & Sharwood Smith 2004a, 2004b). It is not a theory per se but rather a theoretical framework for interpreting research on language development within a broad cognitive-science perspective. It may also be thought of as a research program. MOGUL has already been used to re-examine and reinterpret concepts such as transfer (Sharwood Smith & Truscott 2006) and optionality (Truscott 2007).

According to Jackendoff's basic processing architecture of language, his view of the language module has two main subcomponents of the module controlling, respectively phonological and syntactic structure. This means that the module is itself modularized with phonology and syntax as independent and equal partners (Jackendoff 1987). The phonological (sub) module deals uniquely with phonological structure(PS) and can do nothing else while syntax is processed separately, also in its own unique terms. The outputs of each subsystem, phonological and syntactic structure (SS), need to be chained together to create part of a linguistic representation on-line. This chaining is effected by interface processors whose job it is to a) match up the output of the two linguistic subsystems with each other and b) to match up these linguistic outputs inside the language module with elements outside it, that is to say, outputs underlying meaning (conceptual structure CS) at the higher level, and with peripheral systems involved in speech, signing and writing at the lower level.

The system is bi-directional, the language module as represented here works both for building a representation in production and also in comprehension. The processing differences between the two are essentially in what happens outside or beyond the operations of the language module itself so, of course, production and comprehension processing, taken in their totality, are different.

The MOGUL framework, allows a recasting of questions that are regularly asked about the ways in which language acquisition can be supported or facilitated (Doughty and Williams 1998, Izumi 2003, Mackey 2006, Van Pattten 1990, 1996, Van Patten and Williams 2007). Firstly, it should be clear that focusing on form is focusing on the visual or auditory precursors of linguistic structures and not directly on linguistic form itself. What has also been called ‘input enhancement’ (Sharwood Smith 1993) involves various techniques employed to make salient given features of the language to which the learner is exposed. This still means influencing the way in which the learner constructs perceptual output structures (phonological representation and not linguistic structures (PS or SS). We can make certain things more perceptible and by so doing provide the learner with a clearer, more stable perceptual platform for the language module to operate on.

In a modular account of cognition, each module has its own function and unique set of operating principles, i.e. its unique ‘code’, which makes the overall architecture of cognition look very complex. There is also simplicity in this architecture, however, since all (modular) cognitive processing follows the same generic pattern of having 1) an integrative processor unique to that module whose job is to process whatever elements appear in its working memory plus 2) a memory store and 3) interface processors enabling cross-matching with elements in adjacent modules.

Although, in MOGUL, we are treating modules as processing units, another way of looking at the internal structure of a module is to consider the relationship between processing systems and competence systems (in Chomsky's sense of competence).(Sharwood Smith 2009)

There are two hypotheses that are integral to MOGUL in its current form, both having to do with the concept of activation. The first is the Activation Hypothesis (Baars 1988 and the second is APT, the Acquisition by Processing hypothesis (Truscott and Sharwood Smith 2004a). The

Activation Hypothesis is directly to do with the issue of consciousness and suggests that at least part of the explanation of conscious experience has to do with the activation of elements in memory beyond a certain threshold, an idea that is quite common in theories of consciousness (Baars, 1988, Paradis 1993). The Acquisition by Processing Hypothesis holds that, within the modular architecture adopted in MOGUL, elements of memories (structures) that are invoked or created during attempts to process language on-line, acquire a given resting level that determines their basic availability for selection in subsequent parses. The more the same structures are selected in future parses, the more established they become, that is to say, the higher their resting level of activation becomes.

MOGUL would limit any awareness to awareness of the sound or image of a word (or gesture and facial expression in the case of signing, or touch in the case of Braille). In other words we can only become aware of certain perceptual structures, the precursors of linguistic structure. We cannot become aware of the linguistic structure itself, or put more precisely, of PS and SS. Also, since awareness is generally thought of as admitting of different degrees, then we can both be peripherally aware of a relevant perceptual structure, that is, an AS or VS (but not the PS or SS they are linked with) and we can also be focally aware of highly conscious of an AS or VS.

The generally observed failure of learners to automatically respond to focus on form in such a way as to acquire grammatical structure in the long term (that is ignoring any strictly short term learning effects following some experimental methods) could be explained by the in-principle impossibility of direct access (in terms of awareness) to phonological and syntactic structure. We have the illusion of being aware of linguistic structure because we can be aware of its perceptual correlates.

A modular, domain-specific account explains why this feeling of observing linguistic structure is in fact an illusion and that learning grammar (including) phonology is not as straightforward as its seems it should be. To take awareness of language as an object first, being aware that, for example, ‘When are you going to stop reading?’ a) is a stretch of language, b) is a question, c) consists of seven words and d) is an example of subject-auxiliary inversion is an experience usually qualified by the term ‘metalinguistic’. MOGUL needs to be able to supply a coherent account of metalinguistic awareness as much as any other kind of awareness. It does so in terms of conceptual structure. That is, the language user builds up knowledge about language in CS with links to the perceptual precursors of linguistic structure namely AS (spoken utterances and segments of utterances) and VS (written or signed utterances and segments of utterances). In this way, knowledge of language can be built up outside the language module. An obvious example of this would be an extensive, analytic knowledge of a dead language like Latin or Ancient Greek. However, it includes all the knowledge about our first and other languages that we acquire as a result of formal instruction or self-study from very early on in primary education to the more sophisticated forms of metalinguistic knowledge acquired in adulthood.

Take the notion of a word for example. We have seen that, in one sense, words as such do not exist. They are chains or networks of structures part of which may correspond more or less to our metalinguistic notion of a word and we can certainly relate ‘words’ to identifiable structural elements in phonology or morph-syntax. However the word as a unit comes into its own as a concept (in CS) and is identifiable as an auditory structure (AS) like /step/ or /wen/ or, since we

are literate beings, as visual structure (VS), a sequence of written characters with a space on either side like ‘ s e t ’ or ‘ w h e n ’. In this way, as we progress through life, we develop linguistic knowledge of two types, one as a result of the activity of the language module and another as a result of linking forms and meaning outside the language module. We do the latter together with a set of auxiliary (metalinguistic) concepts like word, syllable, word order, question constructions, adverb, preposition and so on all of which enable us to place these perceptual form-meaning pairs in a broader conceptual context and thereby submit them to various kinds of analysis. Interestingly, whereas the linguistic knowledge developed via the language module can never be wrong or right - it is just the way it is- the manner in which language is developed meta-linguistically can indeed be submitted to value judgment. This means that asking an L2 learner for an intuitive judgment about a question like ‘What you are doing?’ will elicit a response, you hope, that reveals something about the way questions are represented in that learner’s current L2. It may or may not be native-like but it is simply the way the learner handles questions at the time of asking. In itself, it is neither right nor wrong. If we then say that this sentence is ‘wrong’ or ‘non-native-like’, we are making a separate, metalinguistic statement about that sentence which can be tested and judged as true or false. We can also develop an analysis which can be tested and assessed as wrong or right such as an analysis yielding the statement ‘all questions in English require subject-verb inversion’.

MOGUL can provide an account supporting the view that there are two separate types of linguistic knowledge that exist alongside each other (Krashen 1981, Schwartz 1986). Knowledge acquired via the operation of the language module is developed from an early age as a result of mandatory processing. As Fodor (1983) pointed out working with his particular view of modularity, choose not to process language to which you are exposed. In terms of the MOGUL framework used here in which acquisition is carried out via the activities of the parser, you can also not choose to acquire or not to acquire language except by avoiding situations where you will be exposed to speech or writing. However, knowledge acquired outside the language module as currently conceived will not develop automatically on exposure to language but typically requires training and reflection if it is to rise beyond a basic level of metalinguistic awareness without much analysis.

The MOGUL framework as currently conceived can provide a richer set of concepts and a terminology to spell out more precisely ideas, claims and hypotheses that have been advanced in language acquisition over a period of time. The terms and concepts are derived from, in particular, research in linguistics, cognitive psychology and psycholinguistics. As such they should in principle possess some cross disciplinary authority and usefulness. The issues chosen here to illustrate how the MOGUL program can be applied have centered round the question, familiar enough in second language acquisition research at least, of consciousness and its possible role in influencing linguistic development of new language systems in the mind of the language user. A picture has been presented of two language knowledge systems possessed by all kinds of language user and language learner. The two knowledge systems are essentially different. (Sharwood Smith 2009).

Conclusion

The research paper is striving to collect information from different sources to illuminate the path of knowledge for a new trend in acquiring the second language with a remarkable help of the two vital elements of working memory and consciousness. Those essential elements have been vaguely involved in the curricula of language acquisition as much to the educators. The more given knowledge about those elements the more skillfully designed learning programs would emerge. Implementing and immersing them academically, would hopefully antedate a successful extraordinary results to the learning processes and the learners. The role of assessing is recommended to continue applying the process, as a checkpoint, the mogul framework is highly advisable to measure the acquisition and reform any inconveniences to straighten the road of success.

References

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence, The psychology of learning and motivation: II. Academic Press. https://doi.org/10.1016/S0079-7421(08)60422-3

Baars, B. (1988). A cognitive theory of consciousness. New York: Cambridge University Press.

Baddeley,A. & G Hitch - Psychology of learning and motivation, 1974 – Elsevier

Baddeley, A. (2016) .Working Memory (Oxford Psychology Series, No. 11)

Baddeley,A.(2016-2000) Working Memory and Reading Difficulties: What We Know and What We Don't Know About the Relationship.VL - 19-DO - 10.1007/s10648-006-9024-1-JO - Educational Psychology ReviewER

Bialystok, E. 1978. 'A theoretical model of second language learning.' Language Learning 28:69-84.

Cowan, N., Rouder, J. N., Blume, C. L., & Saults, J. S. (2012). Models of verbal working memory capacity: What does it take to make them work? Psychological Review, 119(3), 480–499. https://doi.org/10.1037/a0027791

Cowan, N. (2014). Working Memory Underpins Cognitive Development, Learning, and Education. PMC4207727- Article Pub-Reader PDF–741KCite.

Dehn, M. J. (2008) Working memory and academic learning: Assessment and Intervention. New Jersey: Wiley and Sons.

Doughty, C., & Williams, J. (1998). Pedagogical choices in focus on form. In C. Doughty & J. Williams (Eds.), Focus on form in classroom second language acquisition (pp. 197-261). Cambridge: Cambridge University Press.

Fodor J. A. (1983). The modularity of mind: An essay on faculty psychology. Cambridge, MA: MIT Press.

Hopp, H. (2010). Ultimate attainment in L2 inflection: Performance similarities between non-native and native speakers. Lingua, 120(4), https://doi.org/10.1016/j.lingua.2009.06.004

Izumi, S. (2002). Output, input enhancement, and the noticing hypothesis: An experimental study on ESL gelatinization. Studies in Second Language Acquisition, 24, 541–577.

Jackendoff, R. (1987). Consciousness and the computational mind. Cambridge, MA: MIT Press.

Krishan, S.D. (1981). Second language acquisition and second language learning. Oxford: Pergamum.

Mackey, A. (2006). Feedback, noticing and instructed second language learning. Applied Linguistics, 27, 405-430.

Michael, A. & Sharwood Smith. The University of Edinburgh. Moray House School of Education M.A., Dep. Applied Linguistics, Ph.D.

Rutherford, W. and M. Sharwood Smith. 1985. 'Consciousness-raising and universal grammar.' Applied Linguistics 6:274-82

Savage,M. (2018),The role of memory in learning.

Sharwood Smith, M. (1993). Input enhancement in instructed SLA: Theoretical bases. Studies in Second Language Acquisition, 15, 165-179.

Sharwood Smith, M., & Truscott, J. (2006). Full Transfer Full Access: A processing-oriented interpretation. In A. Sorace & S. Unsworth (Eds.), Paths of development (pp. 201-216). Amsterdam: John Benjamins.

Schwartz, B.D. (1986). The epistemological status of second language acquisition. Second Language Research, 2, 120-159.

Schwieter, J. W., & Benati, A. (2019). The Cambridge handbook of language learning (Cambridge handbooks in language and linguistics). Cambridge University Press.

Schmidt, R., (1990), The Role of Consciousness in Second Language Learning. Applied Linguistics, Vol. 11, No. 2 © Oxford University Press 1990

Shoemaker, E. M., & Wauquier, S. (2019). The emergence of speech segmentation in adult L2 learners of French. French Liaison in Second Language Acquisition / La Liaison En Français Langue Étrangère, 10(1), 22–44. https://doi.org/10.1075/lia.17016.sho

Truscott, J. (2015). Consciousness in SLA: A modular perspective. Second Language Research, 31(3), 413–434.https://doi.org/10.1177/0267658315571195

Truscott, J., & Sharwood Smith, M. (2004a). Acquisition by processing: A modular approach to language development. Bilingualism: Language and Cognition, 7, 1-20.

Truscott, J., & Sharwood Smith, M. (2004b). How APT is your theory: Present status and future prospects. Bilingualism: Language and Cognition, 7, 43-47.

Truscott, J. (2007). Optionality in second language acquisition: A generative processing-orientated account. International Review of Applied Linguistics, 44, 311-330.

Uckachok,C., (2018). Sensory Memory in Psychology. Research gate net.

VanPatten, B. (1990). Attending to form and content in the input: An experiment in consciousness. Studies in Second Language Acquisition, 12, 287-301.

VanPatten, B., & Williams. J. (2007). Theories in second language acquisition: An introduction. New York: Routledge.

Contact email: Wafaa.metwalli@gmail.com