A MOGUL perspective on consciousness and input processing

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Abstract

The MOGUL framework as originally proposed in Truscott and Sharwood Smith in 2004 constitutes an attempt to integrate accounts of language acquisition, including the acquisition of more than one language, with proposals about how language interacts with cognition. Concepts such as noticing and metalinguistic awareness have been the subjects of discussion in the second language research literature for some time now. It is still difficult to see how there could be a genuine understanding of consciousness and its role in language development without a better functional account of awareness of language during on-line processing, one which has its basis in current research within relevant areas of cognitive science. Admittedly, a serious consideration of any aspect of consciousness constitutes a considerable challenge. However, enough has been done in the last two decades to warrant a much more rigorous approach to talking about consciousness in both first and second language acquisition and its role in the processing of linguistic events in the environment. The MOGUL framework is one attempt to answer the challenge.

A MOGUL perspective on consciousness and input processing[1]

INTRODUCTION

In this paper, two major themes in second language theory, consciousness and input processing, will be discussed using a theoretical framework known as MOGUL (Truscott & Sharwood Smith, 2004a; Sharwood Smith and Truscott in prep.). One impetus for creating MOGUL (Modular On-line Growth and Use of Language) was to challenge or refine the thinking behind crucial but nevertheless not very well-defined concepts which are commonly used in acquisition research. Another one was to contribute to a transitional account of language acquisition explaining how and why development is triggered and moves on through time as opposed to accounting for the properties of learner systems at particular stages.

The discussion will begin, necessarily, with an account of MOGUL itself to allow subsequent discussion of the two themes in question. This will cover ground often glossed over in the research background sections of papers reporting investigations into language acquisition. To explain what MOGUL involves will therefore have to occupy a relatively large part of this chapter. In the course of the discussion, one related issue will come into focus, one that links consciousness and input processing, namely the issue of noticing, what noticing means and what its role might be in triggering development[2][1]. Somehow events in the external environment have to be registered in some way by the language user if they are a) to result in message comprehension and b) effect some longer-lasting changes in the way in which the language is processed. A language user may certainly be conscious of being exposed to language. They may also be aware of their own attempts to facilitate their understanding of the language addressed to them as also attempts to commit to memory certain aspects of what they are hearing. A key feature of language acquisition theorising has to be a suitably coherent notion of what noticing is and how noticing impacts on development. Arguably the field has been making do with a number of

concepts related to noticing which are still quite inadequate although there has long been a concern to try and refine thinking in this area (see, for example, Schmidt 1990, 1993, 2001 and Truscott 1998). Linking accounts of on-line processing with accounts of consciousness would seem to be important in order to see whether awareness plays a role in triggering language acquisition and, if so, what that role might be. This is especially the case in the context of MOGUL, which purports to be a processing-oriented framework within which theoretically rigorous accounts of the transition from one stage of acquisition to the next can be developed. But before an account of consciousness and input-processing can be presented, however, key features of MOGUL need to be properly explained.

MOGUL PRELIMINARIES

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[3][2]. MOGUL has already been used to re-examine and reinterpret concepts such as transfer (Sharwood Smith & Truscott 2006) and optionality (Truscott 2007). Although not a theory, MOGUL is by no means theoretically neutral. For example it espouses a domain-specific view of language rather than a general-cognitive or radical connectionist view. Its two main sources of inspiration are the architecture of the language faculty, including its processing dimension, as proposed by Ray Jackendoff (Jackendoff 1987, 2002, 2007) and an approach to consciousness generally known as Global Workspace Theory originally as proposed by Bernard Baars (Baars 1998, 2007). Many current approaches to consciousness in cognitive science literature assume some version of this global workspace approach. Jackendoff's intermediate theory of consciousness is quite different from Baars', however, but, in MOGUL, the two approaches have been reconciled. This has naturally called for a degree of reinterpretation of both Baars' and Jackendoff's accounts in order to achieve theoretical consistency. MOGUL is also largely in line with Pinker's views on language and cognition although it takes a different line with regard to second language acquisition (Pinker 1994,1997).

MOGUL architecture incorporates and integrates notions familiar from different and sometimes incompatible approaches. For example, intuitions that people have that acquisition must be somehow competition-driven and that development must somehow involve the growth of connections find their place and justification within the MOGUL framework. The integration of key concepts in different accounts might in principle end up as a haphazard mix-and-match affair. To make sense, these concepts need to be incorporated in a different and constrained form in order to achieve a theoretically coherent 'big-picture' of what is going on as people use and acquire language. Finally, an important component of MOGUL as currently conceived will be discussed here, that is, APT (Acquisition by Processing Theory), in which acquisition is presented as the by-product of processing hence obviating the necessity of inventing special developmental mechanisms for language (*pace* Carroll 2001) while maintaining a domain-specific 'modular' approach to the language faculty. For this reason it will be important to say something about the role of what are often termed 'long term' and 'working' memory.

A WALK THROUGH MOGUL ARCHITECTURE.

Two key advantages of Jackendoff's approach

Jackendoff's approach to the architecture of the language faculty allows for a discussion of linguistic structure both within a time-free 'competence' perspective, abstracting away from time and space, and, without any radical adaptation, within a time-bound, processing perspective. A second attraction of Jackendoff's approach is that it seeks to make explicit the relationships between core structural properties of language often thought of as constituting the 'language module' and an outer, albeit equally important layer of language knowledge relating to meaning, the semantic and pragmatic aspects of language. This second layer interfaces with other, non-linguistic aspects of cognition such as visual and spatial cognition and this, as will be shown below, plays a major role in the MOGUL account of consciousness and attention.

As indicated above, MOGUL represents an attempt to look at the 'big picture', i.e. 'language and beyond' in a more rigorous and coherent manner, one which reflects plausible and compatible choices from different research areas within cognitive science. It makes general claims about functional architecture of the mind. In other words it is not about neural instantiations. This allows for the development of conveniently more compact and simple models of the mind than would be the case if it was an attempt to model the complex patterns in which neural networks operate and interact across the brain. Areas such as that representing prelinguistic auditory processing can be treated as a distinct functional 'area' while its neuro-anatomical instantiation is considerably more complex involving areas of the brain including, amongst others, Brodman's area (area 41 and

42) and Wernicke's area (area 22). Although it is important to keep these two levels of description separate, it is highly likely that seeking relationships between functional models of the mind and neurological accounts ought be productive and mutually enhancing.

The 'language module' following Jackendoff.

Beginning with the basic processing architecture of language, Jackendoff's 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 modularised with phonology and syntax as independent and equal partners (Jackendoff 1987). The phonological (sub)module deals uniquely with phonological structure 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, 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, i.e. outputs underlying meaning (conceptual structure) at the higher level, and with peripheral systems involved in speech, signing and writing at the lower level. 'Higher' and 'lower' are of course metaphors. One can equally think of the levels as 'inner' and 'outer' layers with the outer layer denoting those systems that mediate between the linguistic system and visual and acoustic events in the environment as portrayed below (the square brackets indicating the language module in Jackendoff's system):

OUTER <= [= interface => PHONOLOGY <= interface =>SYNTAX <= interface=]=> INNER

Both subsystems inside the language module are, as just mentioned, also modular: they each operate separately and blindly (hence fast and efficiently) with their own particular and exclusive code. Note that lexical items, as such, do not exist but are rather chains of structure, each structure individually processed by a specialised processor in the appropriate code so that 'dog' , for example, although we conceive of it as single lexical unit or 'word', is actually a set of three separate elements, i.e., a PS-SS-CS chain. In other words, it arises from a matching of, respectively, specific phonological structure (PS), syntactic structure (SS) and conceptual structure (CS). The third element of the chain (CS) lies outside the core language module, thus:

OUTER <= [= interface => PS <= interface =>SS <= interface=]=> CS

Conceptual structure can be considered to be basic to any account of thinking and consciousness although we cannot become conscious of conceptual structure itself although, as will be explained below, its contents can be projected into awareness via another system .At any rate, this tripartite structure of a lexical item still allows a word as a single unit to make sense as a metalinguistic entity, as a reflection of syntactic principles at work and, in some but not all written languages, as a visually distinct orthographic unit. At the same time, its chain-of-three structure is only the beginning of a much more intricate story because this chain sits in the middle of a much larger web or network of structures as will be shown later on in the discussion.
Finally, the system is bi-directional. In other words, 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. They would have to be since one route involves articulatory systems of various kinds and the other sensory ones although given the phenomenon of sub-vocalization when reading silently, there does seem to be a certain degree of involvement of systems which, on the face of it, are not currently relevant; also, in producing speech we do monitor what we are saying as is evident from self-repairs phenomena so that (self) comprehension is involved in production as well. Also worth mentioning is the fact that, within (this version of) the language module itself, processing, in either production and comprehension, is never just one-way traffic: there will always be bi-directional activity as the PS, SS and CS processors together build the best all-round fit for the message being produced or comprehended.

The internal structure of modules

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).
Take phonology for instance. The principles of phonology, in whatever terms they may be described and explained in theoretical phonology, in this framework are a way of explicating the linguistic properties of the phonological processor, that is, aside from the particular operating principles which this processor uses millisecond by millisecond to assemble structure in real time. The phonological processor in the phonological module (processing unit) operates on structures which reside in a memory store, its equivalent in purely theoretical linguistic terms being a lexicon but one which contains only phonological structures. During on-line processing, structures in this phonological memory-cum-lexicon become activated. Activation means they have become candidates for the current parse and compete for selection as the parser attempts to build a representation. Building a representation involves the processor operating on the most highly activated structures that have won the competition and entered into working memory and integrating them into larger phonological chunks. The interface processors match anything in phonological working memory with items in the memories of the adjacent modules, e.g. its fellow syntactic module. 'Matching up' or 'mapping onto' is the equivalent of assigning indices in generative grammar. In this way chains of structure are built each element of which is in a code that can only be handled by its own specialised processing unit, in other words, according to the particular internal structure of that module. A traditional lexical item, in this way of thinking, is actually a concatenation of co-indexed elements each representing quite different and incompatible codes. It can also be thought of as a rule mapping one element onto another and onto another so as to form the chain-of-three, i.e. a basic PS-SS-CS chain. Although the level of description in which only linguistic principles are discussed is different from the real-time processing level, the attraction of a Jackendovian approach is that one translates very easily into the other. Much of Jackendoff's own work is in terms of the first level but he regularly relates the two levels so that processing is never left entirely out of the picture (see for example Jackendoff 2002, 152-154, 163,196-230)

Three points with regard to memory need to be emphasised. First, note that memory itself is modularised, which is in line with quite a lot of recent and not so recent thinking about the organisation of memory in the mind yielding such terms as 'semantic memory', 'episodic memory' and so on (see contributions to Miyake and Shah 1999, for example). Secondly, the working memory area, as the temporary repository of highly activated structures existing in long term memory, can be seen either as a separate sketchpad or 'blackboard' (one option which Jackendoff prefers; Jackendoff 1987,1997; see also Baddely 1986, 2007) or an integral part of a single system which includes long term memory. Either way, during a parse (the on-line creation of representations), the processor which is unique to the module in question operates on, integrates just those structures that have made it into its working memory. Interface processors do their cross-matching job on the same, highly activated structures. In other words, anything that arrives on the working memory blackboard is automatically operated on by available processors as the system as a whole tries to build a best-fit representation for the task in hand. Thirdly, structures residing in memory have different resting levels of activation depending on how well-established they are. If they have a high resting level they have a better chance of being selected for a parse, i.e. for the final representation, than those rival candidates that have a lower resting level (or, alternatively, to use a different scalar metaphor, a 'higher' threshold level of activation; Paradis 1993). Put another way, those structures that make it into working memory have arrived there as winners in a race for selection in a parse and certain structures have a better chance of winning than others. At the same time, since processing occurs incrementally and in parallel, and since, as more data becomes available on-line, several possible alternative representations that are constructed from elements in working memory may be entertained at once, this means that just making it into working memory does not guarantee final selection for whatever is being produced or comprehended. The ultimate winners are those elements that are selected for the representation that best fits the wider context.

It is worth noting that certain metaphors can be used to describe the properties of on-line processing such as 'parsing strategy' as long as it is understood that there is no homunculus in the system devising strategies as such. The 'strategic' behaviour referred to is shorthand for the essentially blind operation of the processors involved acting according to the general principles of activation and competition interacting with linguistic properties of the various subsystems involved. In the same way, there is no 'competence' box as such on which a separate set of 'performance mechanisms' operate. At the same time, competence, that is, abstract linguistic knowledge, remains a perfectly valid concept and is implicit in the processing system as here described.

Affective structures

Before going on to tackle the issue of consciousness directly, it is necessary first to outline two more crucial components of MOGUL architecture and say something about acquisition by processing theory. The two crucial components concern affective and perceptual aspects of cognition.

To begin with affect, any account of input processing, memory and therefore of learning, cannot do without a consideration of the affective system. Not only have affective factors been discussed as an inhibiting factor on input processing in second language acquisition, there is also the phenomenon known as 'flashbulb memory'; whereby something is apparently learned instantaneously when associated with strong emotion, a phenomenon which might plausibly hold for certain aspects of language as well (Tarone 1979, Brown, & Kulik, 1977). One way or another, any framework which claims to give an account of the big picture, i.e. the cognitive context in which language acquisition and language takes place, must necessarily have a place for affect. In the MOGUL framework, affective structures (AfS) reside in the affective module, the neural implementation of which is commonly located in the limbic system although this position has been strongly criticised (see, for example, Calder et al, 2001). Following the standard pattern of MOGUL architecture, affective structures would be linked via an interface processor with other cognitive structures including conceptual structures (CS). The appropriate primitives would be something like the primary emotions proposed by researchers such as Eckman and Damasio such as, to take one example, anger, disgust, fear, happiness, sadness, surprise which would be conventionally represented in MOGUL as !ANGER!, !DISGUST!, !FEAR!, !HAPPINESS!, !SADNESS! and !SURPRISE! (Eckman 1999, Damasio 2003). The question is, in a modular system, what other structures can affective structures (AfS) be interfaced (or 'indexed') with? Clearly they can be interfaced directly with memories of sounds, images and smells, for instance since sounds, images and smells evoke emotions. However, since the language module is conceived of as a module with a high degree of encapsulation, it should not be possible to associate a syntactic or phonological structure directly with an emotion so how exactly might it be that we can remember a new word or expression after just one exposure when it is associated with a strong emotion? To understand this, it is necessary to understand the role of perceptual structures.

Perceptual output structures (POpS)

As implied above, 'structures' in this discussion, the most neutral way of describing them, can also be thought of as 'memories'. Some might prefer to think of them as perceptual representations. Either way, there have to be some types of structure that constitute the output of our sensory systems, such as those involved in audition and vision, that serve as the basis for building up our internal map of the environment we live and move about in. These perceptual output structures (POpS) underlie our ability to both make sense of events occurring in the world immediately outside us and even experience them when the events themselves are actually not taking place at all such as when we are dreaming, hallucinating or actively trying to imagine a sight or a sound. The POpS are naturally crucial for survival and vary from species to species such that for example auditory and olfactory systems in dogs will be considerably more important than in humans whereas vision will be especially important for humans. This will be reflected in not only the richness of the relevant POpS produced but also the degree to which they are activated vis-a-vis other structures. The most important POpS for language are naturally auditory structures ('sound memories') and then visual structures, referred to as AS and VS respectively. Consider the experience of hearing a word like 'dog'. A moment's reflection will confirm that we experience a word both as a sound (AS) and, if we can associate with a conceptual structure, we experience a feeling of what it means. This experience will be much more complex as a result of linguistic processing. Especially where words come in sentences, elements of that word's meaning clearly derive from the processing of the acoustic signal via the language mdoule. Put another way, the words have been given phonological and syntactic structure as well so that over and above the basic semantics of 'dog', all kinds of extra things are communicated about, say a specific dog, its importance in the narrative, its role as a subject and a topic and so on and so forth. Another way of looking at the processing of the sound of a word is from the point of view of an actual dog. Take the word the word 'walk' for instance. A dog, hearing the word or rather the sound of the word may react enthusiastically: the sound has been linked with a meaning, namely an enjoyable outside activity. In present terms, the dog has an AS-CS connection, a sound-meaning pairing, and also a positive AfS attached to it as well, hence its excitement. However, on hearing the sentence 'you walked, didn't you?' the dog will, of course, only hear the familiar AS 'walk' and again may get excited as the relevant conceptual structure is triggered along with positive affective structure. It has no linguistic system (language module) to process the utterance in a way that will decode the meaning of that whole sentence and put the meaning of 'walk' in context; the result: one disappointed dog. Although massively exposed to English sounds like 'walk', unlike the toddler of the house, our household pet will never be able to construct a natural human grammar as a result of all this exposure to what we as humans know as language. The closest humans can come to this canine experience is by listening to words in another language they have absolutely no knowledge of and which have no resemblance to anything in languages they do know although the language module will automatically make an attempt to associate the auditory structures with a PS and SS and parse it as best it can. The visual equivalent of this auditory experience would be looking at words in an unknown orthography. Even then, we as humans, mostly know that what we are hearing or seeing, but not understanding, is language and the dog, of course lacks even that metalinguistic insight.

In MOGUL, then, auditory structures serve as input to the language module. The AS-PS interface involves the selection of an array of auditory features than can make phonological sense, in other words, that can be matched with some PS so that, in addition to the sound of the word 'walk', an appropriate PS can be activated which can be matched up in turn with a syntactic and conceptual structure, thus:

AS<= [= interface => PS <= interface =>SS <= interface=]=> CS

and in the case of the written word or the signed word, a VS (visual structure) has to replace AS:

VS<= [= interface => PS <= interface =>SS <= interface=]=> CS

In this way, what is purely a 'sight', a visual pattern, can be linked to linguistic structure. The matching of AS or VS to CS will also allow the creation of much more complex CS than would be possible via the simpler extramodular[4][3], non-linguistic route.

Note that as structural chains extend outside the language module, they become webs or networks of co-activated structures. The concept (CS) linked to the PS-SS of 'tiger' for example will have numerous conceptual associations beyond its basic semantics denoting what a tiger is so that the CS network itself will be very extensive. In addition, it will be matched with a host of perceptual output structures such as visual, auditory, tactile, perhaps olfactory structures too, and many of these may connect up separately to affective structures such as !FEAR!. Structures at either end may be associated with AfS (affect structures) and so, while a particular matching within the language module is sequential the resulting interconnectedness beyond the module ceases to have the character of a simple chain.

Activation in MOGUL

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, i.e the higher their resting level of activation becomes. Selection within any given module involves competition. Structures with a high resting level will a better chance of winning out in any competition. One consequence of this is that some L2 structure might have recently been established in memory but, because its resting level is so low, it will regularly be outgunned by stronger rivals (e.g. by similar L1 candidates) in a parser's attempt to process an L2 utterance. More experience with a language will, *ceteris paribus* increase the resting levels of more recently established structure increasing their chance of getting selected. A lack of experience, even with an L1, will make structures in that language (dialect, variety, register, etc.) relatively less accessible and therefore less likely to win any competition for selection. APT therefore can provide an account for language attrition, as well as acquisition phenomena.

Note that this continuous readjustment of resting levels as a result of experience is a local phenomenon. Activation and competition takes place within given modular systems. APT certainly does not predict that frequent items in the environmental input will automatically acquire higher resting levels and become more accessible. This only holds if we are talking of input as internal input, internal, that is, to a specific module rather than external input in the environment (Carroll 1999, 2001). Hence, in MOGUL, some linguistic feature occurring in speech addressed to the language user may be processed even as far as AS but it has got to be processed further, i.e, successfully matched up with some PS to qualify as linguistic input. If an inflectional morpheme on the end of a verb, for example, is not given a PS, it cannot hope to have any impact on grammatical development because there will be nothing to be matched up with an appropriate SS however much the language user is exposed to samples of that inflection. This demonstrates how MOGUL is only connectionist in a liberal sense and not in a radical, eliminativist sense (Rey 1991) because the external frequency of, notably, signals of a given linguistic feature in the environment, does not have to lead to any changes in the language users' internal linguistic system.

The distinction between linguistic structures (PS and SS) and perceptual output structures such as AS is also significant from the point of view of consciousness. POpS are typically mutually enhancing and hence gain very high levels of activation , presumably with additional input from the affective system. This allows them to cross

the consciousness threshold. However, PS and SS within the language module are not capable of such high levels and hence their contents are inaccessible to awareness. In this way it is possible to become consciously aware of the AS corresponding to the word 'dog', that is to say the sound of the word, or its visual (written) equivalent, a VS, but we cannot become conscious of its internal linguistic structure, that is, to be more specific, its phonological or morphosyntactic structure.

AWARENESS OF LINGUISTIC FORM AND MEANING RE-EVALUATED

The logical problem: <u>what</u> is noticed?

Thus far, a sketch has been given of the cognitive environment in which linguistic processing takes place. A crucial role in the interface with the language module (in its Jackendovian form) is played by what, in MOGUL, have been termed perceptual output structures. These are richly interconnected with each other enabling high levels of activation: this is understood to be important for survival. As a result of this rich interconnectedness, high levels of activation can be generated to enable the phenomenon of awareness. Perceptual structures are also connected up with conceptual structures, enabling sensory experiences to have meanings, and to the affective system to enable a system of evaluation whereby, for example, a given visual structure corresponding to the image of a tiger, for example, would evoke a sensation of fear. The affective system is also understood to influence levels of activation in particular ways. Apart from the language module, the system in its essentials as described above will be similar for many animals as well albeit with very different biases and degrees of complexity. The language module is, of course, crucial for the acquisition and use of human language. Finally, the system described in MOGUL terms is a particular interpretation and integration of findings in various relevant areas of cognitive science.

Now, moving on to applications of MOGUL, it is appropriate to ask about nature and object of what is frequently referred to as noticing. In order for someone to be influenced by any stretch of language to which they have been exposed in such a way to undergo developmental change, something needs to get registered, noticed, recorded, however one wants to describe the process. This is a logically necessary first step for development to take place. The extensive literature dealing with this aspect of the acquisition process requires us to answer these questions. Without going into the controversy surrounding the notion of noticing (see for example Schmidt 1990, 2001, Gass 1997, Truscott 1998), 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 (POpS), 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, i.e 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.

Two possible objections to the proposed inaccessibility of linguistic structure to awareness

It is important to explain the apparent ability we have to analyse and talk about the linguistic structure of what we hear and read if we are, in MOGUL terms, supposed to be completely unaware of it. Another objection might be raised, namely that no account has been made of meaning. If we are not aware of PS and SS, are we nevertheless aware of the semantic and pragmatic structure of language, in short, its meaning? And what does it mean to be aware of meaning?

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 very much 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 morphosyntax. 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 metalinguistically 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'.

In sum then, 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. You cannot, as Fodor pointed out working with his particular view of modularity, choose not to process language to which you are exposed (Fodor 1983). 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. Once acquired however it may to some extent, *pace* Krashen, be deployed skilfully and without reflection (for further discussion, see Sharwood Smith 2004, 2008).

The second question has to do with awareness of meaning. Can you become aware of conceptual structure which surely has to be where thought is created? The answer in MOGUL is no. As mentioned earlier on in this chapter, conceptual structure is also inaccessible to awareness. We are no more aware of semantic and pragmatic structure than we are of PS and SS. Since, however, CS is richly connected with the perceptual system and POpS supports awareness when the level of activation is high enough, we experience the phenomenon of thinking via our perceptual system (but not just via visual imagery; see dsicussion in Pinker 1997 89fff). That, at least, is the hypothesis. This means that focusing on form in the sense of becoming aware of a linguistic form to which you have been exposed, with or without teacher intervention, means in effect focusing on the perceptual precursor to that linguistic form. If you possess sufficient metalinguistic knowledge, it also means being able to recognise what you are focusing on as an example of a word, a word ending (suffix), a marker of 3rd person etc. If your attention is directed to the meaning of a word or string of words, you become aware not of the conceptual structure per se but you experience its sense and associated thoughts arising from that conceptual structure via the POpS system. This awareness will be more or less intense or transitory according to the level of activation, assuming the activation is great enough to cross the awareness threshold. Since PS and SS are, unlike conceptual structure, not directly connected to affective structures, no amount of emotional excitement will raise PS and SS across the activation threshold . The perceptual precursors of PS (AS or VS) will indeed be accessible to awareness so we can under certain condition become intensely conscious of the sound or sight of a word; its meaning, the contents of its conceptual structure, will also feature in our conscious experience but only by virtue of being projected onto perceptual structures . Following Acquisition by Processing Theory, these perceptual structures along with the meanings associated with them, will acquire higher resting levels of activation level and become more available during subsequent processing. At the same time the internal phonological and syntactic organisation of the perceived will not be influenced at all. The interface between AS (or VS) and PS can work perfectly well be without anything stronger than the residual, peripheral awareness that typically accompanies the act of listening to speech or reading texts. By the same

token, development can take place under the same circumstances following the Activation by Processing Hypothesis (Truscott and Sharwood Smith in prep).

FOCUS ON FORM AND INPUT PROCESSING

The MOGUL framework, in the version presented so far, allows a recasting of questions that are regularly asked about the ways in which language acquisition can be supported or facilitated (see for example, Doughty 2003, Doughty and Williams 1998, Izumi 2003, Mackey 2006, VanPattten 1990, 1996, VanPatten 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 . Focusing on form as commonly understood is, therefore, an illusion.

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 and not linguistic structures (PS or SS). In other words 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. We cannot however force the language module to process the resulting perceptual structures however highly activated, valued and stable they are. You can take a horse to water but you can't make it drink, goes the expression. This means that we can improve the perceptibility of some linguistic forms in the hope that the language module will have higher quality material to work on. To this extent the importance of processing instruction in the sense of VanPatten (1996) is upheld, even more so when it comes to making the intended meaning of an utterance clear. In order to build a successful PS-SS-CS chain, the learner, or rather the learner's language module, needs to be able to establish links between PS-SS chains which are built from any current input into PS, and conceptual structure. Anything that helps the learner to construct appropriate conceptual structure for the interpretation of an utterance must provide a good basis for building an appropriate representation but, again, creating such an optimised context is one thing, producing an effect on the independent operations of the language module is quite another.

CONCLUSION

The intention has been to illustrate how 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 crossdisciplinary authority and usefulness. The issues chosen here to illustrate how the MOGUL program can be applied have centred 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. They live alongside one another and contribute in different ways to learner performance and the growth of new knowledge. More importantly , the more precisely and authoritatively we can frame hypotheses about such issues of processing and representation, the more chance we have of coming up with empirical investigations that can deliver good explanations.

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[2] Truscott and Sharwood Smith (in preparation) deals exclusively with the notion of noticing
[3] Thanks are due to Harald Clahsen whose suggestion it was that the MOGUL framework could usefully be described in this way, i.e. as a research 'program'.
[4] 'Extramodular' in the sense of beyond, specifically, the language module and temporarily disregarding the existence of many other modular systems involved in cognition.