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For Type A Syllabi: A Connectionist, Emergentist View

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Abstract

Type A syllabi, including structural, functional/notional, situational, topical, lexical syllabi, have usually been severely criticized for dismantling the language/ communication into their components and presenting them gradually and linearly so that the learners have to accumulate and assemble these separate pieces to establish the whole language. This paper intends to demonstrate that such criticism and even others are not supported by current findings of the connectionists and emergentists since these cognitive models of learning as well as the Competition Model, through their elaborate research, have manifested that learning actually happens through gradual development and strengthening of the neural interconnections by repetition and hypothesis making due to cue validity and frequency. The required modules for the whole language learning naturally emerge in the different zones of proximal development through frequent interactions with the social environment. Therefore, the notorious Type A syllabi could be even more adequate and practical especially for the beginners due to their teachability and learnability as well as their ease of assessment, compared with those celebrated Type B ones.

Keywords: Type A syllabi, Type B syllabi, Connectionism, Emergentism, The Competition Model

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Type A syllabi, also known as propositional, product-oriented, or synthetic, are harshly criticized for their dismantling the *language/communication* into its components and gradually feeding them to the learners linearly so that the process of language learning comprises the step-by-step accumulation of the parts of the puzzle to create the whole (Nunan, 1988). Moreover, it is firmly claimed that different types of Type A syllabi, i. e. Formal (structural), functional, situational, topical and lexical syllabi, share a static target language, product orientation, are ultimately based on an analysis of the *language* to be learned, and implicitly rely on "the validity of the equation: what is taught = what is (or ought to be) learnt" (Prabhu, 1984, p. 273). In preserving the traditional roles of syllabus designer, teacher and student, and in adhering to a view of language as a linguistic rather than a psycho/sociolinguistic process involving the acquisition of social and cultural knowledge, they ignore the learner as a significant participant in his/her own language learning, defending the idea that the forms of a language can somehow be learned, prior to communication, despite the claims of several first and second language acquisition researchers that grammar develops out of conversation or other language use. As Newmark (1966, cited in Finch, 2000) observes, "if the task of learning to speak English were additive and linear ... it is difficult to see how anyone could learn [it] ... Language is learned a whole act at a time, rather than as an assemblage of constituent skills" (p.77).

Here, in this paper, it has been attempted to indicate that these criticisms against Type A syllabi seem rather baseless and unrealistic due to the new findings in cognitive psychology, that is, connectionism, the Competition Model and emergentism. These cognitive models and researches demonstrate that human beings learn things not on the bases of a holistic, analytic approach; rather, things are learned through step-by-step development of interconnections among a neural network, developing and emerging stronger connections and modules due to the limited capacity of the working memory. The claim of the linearity of this type of syllabi have been easily solved by the spiral approach, and as it will be indicated, it is not a merely linguistic approach to language learning since it is based on the natural development of neural networks to learn something. To do so, first, we will consider the claimed difference between Type A and Type B syllabi; then, we will discuss the psycholinguistic underpinnings of Type A based on the current researches of connectionism and emergentism in light of the Competition Model.

Type A vs. Type B syllabi

The evolution of syllabus design can be seen as a progression of assumptions about language learning, classified by Breen (1987) according to two main paradigms or frames of reference, one of these being established and prevailing (termed ‘propositional’ after the notion of propositional representation of knowledge from cognitive science, and the other recently emerging (termed ‘process’) (Breen, 1987a, p. 81). In second language learning, the established

paradigm is typified by *formal* and *functional* syllabi and interprets language through a propositional plan and a formal, system-based statement of the knowledge and capabilities required when studying a new language. The emergent paradigm is concerned with *how* something is done (Breen, 1987b, p. 160), including how to communicate in the classroom and how to learn how to communicate, and is typified in *task-based* and *process* syllabi:

> In essence, each of the four types of syllabus offer alternative answers to the question: What does a learner of a new language need to know, and what does a learner need to be able to do with this knowledge? (Breen, 1987a, p. 85).

Long and Crookes (1993), paralleling Breen's attention to paradigms, suggest a distinction between "two superordinate categories, analytic and synthetic syllabi", and White (1988) further distinguishes between "Type A" and "Type B" syllabi (p. 44). The term 'synthetic' refers here to structural, lexical, notional, functional, and most situational and topical syllabi, in which acquisition is a process of gradual accumulation of separately taught parts, building up to the whole structure of the language. The learner is exposed to a deliberately limited sample of language at any time, and has to "re-synthesize the language that has been broken down into a large number of small pieces with the aim of making this learning task easier" (Wilkins, 1976, p. 2). Thus synthetic syllabi:

> ... rely on learner's (assumed) ability to learn a language in parts (e.g. structures and functions) independently of one another, and also to integrate, or synthesize, the pieces when the time comes to use them for communicative purposes. (Long & Crookes, 1993, p. 12)

In 'analytic' syllabi, prior analysis of the total language system into a set of discrete pieces of language is largely unnecessary: "Analytic approaches ... are organized in terms of the purposes for which people are learning language and the kinds of language performance that are necessary to meet those purposes" (Wilkins, 1976, p. 13). Thus 'analytic' refers not to what the syllabus designer does, but to the operations required of the learner. "Since we are inviting the learner, directly or indirectly, to recognize the linguistic components of the language he is acquiring, we are in effect basing our approach on the learner's analytic capabilities" (Wilkins, 1976, p. 14). Analytic syllabi present the L2 in chunks, without linguistic interference or control, and rely on the learner's ability to induce and infer language rules, as well as on innate knowledge of linguistic universals. Procedural, process and task syllabi are examples of the analytic syllabus (Long & Crookes, 1993, p. 11).

White's Type A and Type B syllabi (White, 1988) contrast an interventionist and a non-interventionist approach, being respectively concerned with the "What" and the "How" of learning, and are similar to Breens' propositional

and process paradigms. Thus Type A syllabi focus on content and the pre-specification of linguistic or skill objectives, and Type B on an experiential, 'natural growth' approach, "which aims to immerse the learners in real-life communication without any artificial pre-selection or arrangement of items" (Allen, 1984, p. 65) (Table 1):

Connectionism

The term connectionism was first mentioned by Thorndike in 1898. But it was not until the early 1980's that connectionist approach became significant in cognitive psychology (Elman, 2008). Connectionism has its root in cognitive and computational neuroscience (Gasser, 1990; Jacobs & Schumann, 1992). "Cognitive neuroscience refers to attempts to understand the biological bases of mental events, including language …. Computational neuroscience investigates how neural networks interact to process information" (Jacobs & Schumann, 1992, p. 284).

What connectionism claims

Connectionism tries to explain human mental abilities in terms of artificial neural networks. In other words, it likens the brain to a computer that consists of neural networks. A neural network consists of large number of nodes/units joined together to form a network of interconnections. Each of these nodes can be connected to different networks. Figure 1 shows the simplest form of a connectionist network organized into three layers: an input layer which receives information to be processed, an output layer where the results of the processing are found, and a layer in between called hidden which is a layer of internal processing. They are called hidden because they do not respond directly to the input or produce a response. As Poersch (2005) asserts it is helpful to think of each node or unit as a neuron that receives activity from other neurons through synaptic connections. Nodes influence the activity of their neighboring nodes at their level or different levels depending on the strength of the connection between nodes. That is, each node receives input which may be excitatory or inhibitory from some other nodes. Then it responds to that input by exciting or inhibiting other nodes to which it is connected. The strength of a connection between nodes is often referred to as *weight*. Knowledge is stored in these interconnection strengths. It follows from this that knowledge is not stored in one place but in the interconnections between the nodes in the form of a network. Knowledge is actually distributed among many interconnections. Therefore, learning is a by-product of processing. Connectionism claims that in language learning, learners are sensitive to regularities in the language input and extract probabilistic patterns from these regularities. Learning occurs as these patterns become strengthened by repeated activation. It is worth rementioning that the patterns themselves are not stored, rather the connection strength between nodes that allow these patterns to be

created are stored (Andrade & May, 2004; Elman, 2008; Mitchell & Miles, 2004; Ellis, 1994, Thomas & Karmiloff-Smith, 2002; Waring, 2008).

N. Ellis (2006) declares that human being is sensitive to three variables in learning process: *recency*, *frequency* and *context*. Recency refers to the probability of recalling an item. Frequency refers to the probability of a word occurrence. "The more a stimulus is encountered, the faster and more accurately it is processed." (p. 5). Context plays an intervening role that is the effects of recency and frequency are qualified by immediate context. In other words, "a particular word is more likely to occur when other words that have co-occurred with it in the past are present." (p. 6). For example, we process collocates faster and we usually identify them as a unit. Therefore, a word is more likely to occur if it has occurred previously and if it occurs with a string of words associating it in the past. This describes the relationship between practice and performance in the acquisition of language. In this regard, Elman (2008) asserts that prior context often plays an important role and influences comprehension and he refers to this influence as "context effect" (p. 7).

Calling language learner intuitive statisticians, N. Ellis (2006) elaborates that language learning is an intuitive statistical learning problem which involves "the associative learning of representations that reflect the probabilities of occurrence of form-function mappings" (p. 8). Most words have multiple meanings, but it seems that only one at a time becomes conscious. To explain this phenomenon, MacWhinney *et al.* (1985, as cited in N. Ellis, 2006) demonstrated that a cue which first is focused is one which has the highest overall validity. Cue validity is measured by its availability (its frequency or probability of occurrence) times its reliability (its probability of correctly indicating the interpretation). In addition, MacWhinney asserts that a cue with high availability but low reliability may initially be used over a cue that is of lower availability, even though it is more reliable. In the initial stages of acquisition, learners focus on one cue to begin with, later on, they will add a second cue and begin to use the two in combination.

What connectionism accounts for Associative learning

Connectionism is based on associationism whose fundamental belief is that learning could be regarded as the formulation of association between previously unrelated information based on contiguity. Certainly connectionism includes much more than this belief. In this view, human mind looks for associations between elements and creates links between them. The links become stronger as the associations keep running, and they become part of larger networks as connections between elements become more numerous. Clearly the richer the network of associations, the more chance there will be of learning (Elman, 2008; Mitchel & Miles, 2004; Waring, 2008)

Lack or partial knowledge

This model can account for lack, partial and incorrect storage of knowledge. This can be justified as the strength of the connections between nodes. Items which are not repeated or met frequently have weak interconnections.

Therefore, constant practice and reinforcement is necessary to strengthen the interconnections (Waring, 2008).

Incremental learning

Changing the strength of the connections in response to neural activity usually takes place gradually. There are successive and/or recursive steps in learning in such a way that the network's response accuracy would improve over time. For example, interlanguage is not considered as part of L1 or L2 but as something formed increasingly and systematically. It is a system learner constantly updates (or has fossilized) (Poersch, 2005; Waring, 2008, Elman, 2008). Waring (2008) puts the following:

> Connectionism rests on the assumption that we learn by trial and error in successive steps, incrementally and through exposure to input. Successive steps in the learning process alter the associative interconnections by strengthening or weakening of the interconnections….As new information is added, new interconnections are made to different nodes to account for this.

N. Ellis (2006) refers to this property as "variable by variable incremental sequence" (p.15).

Individual variation

Connectionism can account for individual variation. It is believed that each learner has different networks of associations and interconnections even when they share the same L1 and they receive the same input. However, there exists variation among them (Poersch, 2005; Waring, 2008)

Non-linear learning

PDP model demonstrates processing carried out in parallel rather than serially and linearly, that is many processes take place simultaneously (Andrade & May, 2004; Poersch, 2005; Waring, 2008). In this regard, Elman (2008) asserts that "there was growing evidence that the human cognitive system was able to process at multiple levels in parallel, rather than being restricted (as was the digital computer) to executing a single instruction at a time." (p. 7). For example, in language processing, semantic and syntactic factors constantly interact with each other and it is not possible to say which one is primary (McClelland, Rumelhart, & Hinton, 1986 as cited in Ellis, 1994).

Graceful degradation

Connectionist networks exhibit a property known as graceful degradation. If one part of the system is damaged or deteriorates, the language producer can resort to other words because the forgotten word is connected to other words which could replace it. Suppose that a learner has learned the word collapse but at the time of speaking she can not access it. In that case, a substitute word

could be found from within the network such as fall down (Andrade & May, 2004; Waring, 2008).

Complex, dynamic and self-organizing learning

The PDP networks are complex, dynamic and self-organizing. They are complex and dynamic in a sense that the nodes are organized into different levels and they change in a continuous manner in which there is never an end state and there is never any state which is totally separate from the next. They are also self-organizing that is the network self-organizes its output. When there is a mismatch between the network's response and the desired response, the information is fed back to the network by a method called *back propagation* (Andrade & May, 2004; Ellis, 1994; Elman, 2008; Thomas & Karmiloff-Smith, 2002).

Differences from traditional symbolic view

As mentioned earlier, the emergence of connectionism is a clear example of paradigm shift. Therefore, it is important to distinguish connectionism and connectionist models from the traditional symbolic view and its rationalist theories. The following are the major differences between them:

A summary of the differences between traditional, symbolic view and connectionist view is presented in table 1.

Learning in this model is defined as "adjustment to the network". That is, when a gap between pre-existing knowledge and new input is noticed, the learner can readjust the network to accommodate this knowledge. To do the adjustment, there has to be a communication between the network and working memory. However, this model is not free from limitations. For example, the concept of central executive is not very transparent. It is not clear what is and what is not governed by the central executive (attentional processing vs. automatic processing) (Waring, 2008). There have been other cognitive models such as Competition Model and emergentism which attempt to find solutions for those criticisms and shortcomings.

Connectionism and the Competition Model

Connectionists like Piaget view mind as a module. But, they differ from Chomsky's modularity in that for them language faculty is not a module. Besides, like behaviorists, they focus on the strength of association between stimuli and responses. Reviving parallel distributed processing (Rumelhart & McClelland, 1986), connectionists believe that brain is like a computer that would consist of neural networks: complex clusters of links between information nodes. These links of connections become activated or weakened through activation or non-activation, respectfully. For example, according to Lightbown and Spada (2006) when a child hears a word in the context of specific object, event or person, an association is created in the mind of the child. Therefore, whenever the child hears that word, it brings to her mind that

object, and whenever she sees the object, it brings to her mind that word. Eventually any characteristics of that object or event may trigger the retrieval of the associated word. Language acquisition is, therefore, seen as a result of these types of associations rather than the construction of the abstract rules. Connectionists believe that human mind is pre-disposed to find association between the elements and create links between them (Michell & Myles, 1998). "As learners are exposed to repeated patterns of units in input, they extract regularities in the pattern; probabilistic associations are formed and strengthened" (Troike, 2005). The association will be stronger if the frequency of input and nature of feedback should be more. The claim that this type of learning is neither innate nor rule-based is supported by computer simulations. In learning irregular verbs, it is known that children go through three phases: first they produce the correct form of irregular verb, i.e. *went.* In the second phase, they over-generalize the regular past tense ending to irregular verbs, i.e., *goed*, known as U-shape curve of learning for irregular verbs, and in the third phase, they produce irregular form correctly. Rumhelhart and McClelland (1986) demonstrated that a computer that is programmed with a "patterned associator network" can learn to associate English verb bases with their appropriate past tense forms without any *a priori* rules (Troike, 2005) and that it does so with much the same learning curve as that exhibited by children learning their L1.

Pinker (1991, cited in Michell & Myles, 1998) states that irregular verbs are retrieved from an associative memory, like what connectionists have described, but regular verbs are produced by learners as a result of suffixation rule. N. Ellis and Schmidt (1997, cited in Michell and Myles, 1998) investigated the claim made by Rumelhart and McClelland (1986) using regular and irregular plural morphology. Their findings supported the claim made by Rumelhart and McClelland (1986). They concluded that associative mechanisms are all that are needed in order to explain the acquisition of plural morphology. Their finding did not support Pinker's finding that regular morphology of past tense was rule-governed and the irregular associative.

Competition model (Bates & MacWhinney, 1981; MacWhinny, 2001) of language learning offer a theory of *performance* in contrast with Chomsky's theory of *competence.* Competition model challenges Chomsky's deterministic model of language learning, innate hypothesis. Besides, they claim that language learning is non-modular and is not domain specific (Jordan, 2004). Relevant to the discussion in this paper is two of the theoretical commitments. The first one is the *connectionist* model which competition model uses to model the interaction between lexical mappings. There, they reject nativist view and argue that brain relies on a type of computation that emphasizes patterns of connectivity and activation. The second one is that of *input- driven learning*. According to this commitment, learning is explained in terms of input rather than innate principles and parameters. Cue validity is the key construct in this explanation. The basic claims of competition model is that cues such as stress, intonation, rhythm, morphological marking, and word order are available in input and language processing involves competition among these

cues. Different types of cues interact dynamically every time children or adults hear a sentence. Word order or first position of nouns is very strong cues for English speakers. However, a strong cue in one language might be a weak cue in another. Transfer of L1 cues to L2 is something which is likely at early stages of SLA when the systems differ. Research in this issue is, however, not conclusive (Troike, 2005).

Emergentism

Emergentism began as an alternative to both empiricism and stipulationism. An emergentist account provides a specific mechanism that works to generate the observed behavioral patterns. In an emergentist account, generativity emerges not from stipulated rules, but from the interaction of general mechanisms. In fact, most emergentists believe that language ability emerges from the very basic cognitive mechanisms that are in charge of other cognitive developments, such as body movements. In other words, "the emergentist approach to language acquisition views language as a structure arising from interacting constraints… The formalisms that are used to express these nonlinear patterns of interaction include neural network modeling (Fausett, 1994), dynamic systems theory (Port & van Gelder, 1995), and structured approaches such as Optimality Theory." (MacWhinney, 1998, p. 200)

Gregg (2003) defines emergentism as:

> '*Emergentism*' is the name that has recently been given to a general approach to cognition that stresses the interaction between organism and environment and that denies the existence of predetermined, domain specific faculties or capacities. Emergentism thus offers itself as an alternative to modular, 'special nativist' theories of the mind, such as theories of Universal Grammar (UG). In language acquisition, emergentists claim that simple learning mechanisms, of the kind attested elsewhere in cognition, are sufficient to bring about the emergence of complex language representations. (p. 95)

Emergentism replaces the traditional opposition between nativism and empiricism with a new conceptual framework. It is explicitly designed to account in mechanistic terms for interactions between biological and environmental processes. "The goal of emergentism is to replace accounts based on stipulations with accounts in which structures emerge from the interaction of known processes. However, it must do this without sacrificing mechanism and generativity." (MacWhinney, 2002, p. 21)

Emergentism often emphasizes the extent to which a complex set of behaviors and forms can arise from a few simple mechanisms in specific timescales (MacWhinney, 2005a). MacWhinney (2006b, p. 732) states,

"Linguistic form arises from interactions between the shape of the body, cognitive processing, and the nature of interaction across a wide variety of timescales." Therefore, seven timescales have to be taken into account when we are trying to investigate the developmental routes of a chaotic complex system, such as language.

Moreover, according to Bates (1999, as cited in Hernandez, Li, & MacWhinney, 2005), "Modules are made, not born"; that is, they are emergent and one module might compete with another. Competition Models have tried to indicate how these modules are shaped through the passage of time and developed into separate systems like in bilingualism or a falsified system such as a fossilized dialect.

Emergence of grammar

Through their evolutionary stages, languages have adopted various mechanisms to convey their meanings, commonly known as grammar. For instance, the Competition Model focuses on the channel capacity for using language. A human language can utilize four types of signals to convey its meanings: *word order, vocabulary, morphology*, and *intonation*. However, the human information processing system can use only a limited number of things at a time, so human languages have adopted different ways of coping with these four types of signals into the same channel. In fact, different aspects of language compete for the same limited processing space. L1 acquisition involves acquiring appropriate weightings for each of these four factors, deciding which factors are crucial to processing (MacWhinney, 1989).

Emergence of the lexicon

The child's search for word meanings is guided by lexical principles. For example, children assume that words refer to whole objects, rather than parts of objects (MacWhinney, 1998, 2002). The tendency to avoid learning two names for the same object emerges naturally from the competition between closely-related lexical items (MacWhinney, 1989).

Early word learning depends heavily on the spatio-temporal contiguity o f a novel object and a new name. The formation of a link between a particular referent and a new name is referred to as 'initial mapping' (MacWhinney, 1998, 2002, 2005a). This initial mapping is typically fast, sketchy, and tentative. Most lexical learning occurs after the formation of this initial mapping. As the child is exposed repeatedly to new instances of an old word, the semantic range of the referent slowly widens (MacWhinney, 1998, 2002, 2005a).

Conclusion

As it has been indicated, the language learning process occurs through repeated interactions among neurons and developing and emerging stronger interconnections among them (developing stronger cue validity), which will

lead to the emergence of both grammar and lexicon, based on the connectionist and emergentist findings. As Bates (1999, as cited in Hernandez, Li, & MacWhinney, 2005) states, "Modules are made, not born", and this will be accomplished through gradual accumulation of the pieces of the language through interaction and hypothesis development. Those necessary modules and nodes will be developed in the brain step-by-step as the learner/child cognitively mature in their social interaction, passing different zones of proximal development. Therefore, a Type A syllabi which present the language in spiral/circular pieces to be acquired by the learners through appropriate steps of difficulty and learnability seem to be a more practical and natural way of learning a second/foreign language. Moreover, language cannot be processed as a whole due to the limited capacity of the working memory, thus the claim of Type B proponents to holistically present the language to be analyzed by the learners, though idealistic, could not be possibly quite realistic according to the Competition Model.

As a result, Type A syllabi are based on both linguistic and psycholinguistic bases and will eventually lead to the acquiring the language as a whole. Especially at the lower levels of language learning, emphasis on experiential, process learning through tasks seems unpractical due to the learners' insufficient competence of the require components of language. Rather, a step-by-step development of teachable and learnable pieces of language will probably construct the required basic interconnections among the neurons for further experience in language learning. This does not mean that a merely structural or functional approach would suffice; rather, an integrated Type A syllabus might be the best choice for the beginners since it would give the learners the sense of achievement and accomplishment of the certain pieces/products and would provide the teachers with more observable and objective way of teaching and evaluating.

Moreover, if a syllabus is Type A, it does not mean it has ignored the needs and affections of the learners since such precautions are usually made in every needs analysis especially for ESP courses where Type A syllabi, such as functional/notional or lexical ones, seem more appropriate and practical, compared to Type B.

On the other hand, what is taught should also be noticed to be learned according to Schmidt's Noticing Hypothesis, and Type A syllabi provide a better chance to raise learners' awareness of various language components. In addition, Type A syllabi can also be developed and implemented through authentic tasks and does not necessarily entail boring linguistic exercises.

References

Andrade, J., & May, J. (2004). *Cognitive psychology*. New York: Garland Science/BIOS Scientific Publishers.

Bates, E. & MacWhinney, B. (1981). Second language acquisition from a functional

perspective: pragmatic, semantic and perceptual strategies. In H. Winitz (ed.), *Native Language and Foreign Language Acquisition* (pp.190–214). New York: New York Academy of Sciences.

Breen, M. P. (1987a). Contemporary paradigms in syllabus design, part I. *Language Teaching, 20*/2, 81-91.

Breen, M. P. (1987b). Contemporary paradigms in syllabus design, part II. *Language Teaching, 20*/3, 158-174.

Ellis, N. (2006). Language acquisition as rational contingency learning. *Applied Linguistics, 27* (1), 1-24.

Ellis, R. (1994). *The study of second language acquisition*. Oxford: Oxford University Press.

Elman, J. L. (2008). *Connectionism, artificial life, and dynamical systems: New approaches to old questions*. Retrieved from http://crl.ucsd.edu/~elman/Papers/companion.pdf.

Elman, J. L. (1999). The emergence of language: A conspiracy theory. In B. MacWhinney (Ed.), *The emergence of language* (pp. 1-28). Mahwah, NJ: Lawrence Erlbaum Associates.

Finch, A. E. (2000). *A formative evaluation of a task-based EFL program for Korean university students*. Unpublished Ph.D. Thesis: Manchester University, U.K.

Gasser, M. (1990). Connectionism and universals of second language acquisition. *Studies in Second Language Acquisition, 12*, 179-199.

Gregg, K. R. (2003). The state of emergentism in second language acquisition. *Second Language Research, 19* (2), 95-128.

Hadley, A. O. (2003). *Teaching language in context*. Boston: Heinle & Heinle Publishers.

Jacobs, B., & Schumann, J. (1992). Language acquisition and the neurosciences: Toward a more integrative perspective. *Applied Linguistics*, 13, 282-301.

Hernandez, A., Li, P., & MacWhinney, B. (2005). The emergence of competing modules in bilingualism. *Trends in Cognitive Sciences, 9*, 5, 220-225.

Jordan, G. (2004). *Theory construction in second language acquisition.* Amesterdam: John Benjamin.

Lightbown, N., Spada, N. (2006). *How languages are learned*. Oxford: Oxford University Press.

Long, M. H., & Crookes, G. (1993). Units of analysis in syllabus design: the case for the task. In G. Crookes, & S. M. Gass (Eds.). *Tasks in a pedagogical context* (9-44). Cleveland, UK: Multilingual Matters.

MacWhinney, B. (2007). A unified model. In N. Ellis, & P. Robinson (Eds.), *Handbook of cognitive linguistics and second language acquisition*. Mahwah, NJ: Lawrence Erlbaum Press.

MacWhinney, B. (2006a). The emergence of linguistic form in time. *Connection Science, 17*, 191-211.

MacWhinney, B. (2006b). Emergentism: Use often and with care. *Applied Linguistics, 27*/4, 729-740.

MacWhinney, B. (2005a). The emergence of linguistic form in time. *Connection Science, 17* (3-4), 191-211.

MacWhinney, B. (2005b). Language evolution and human development. In D. Bjorklund, & A. Pellegrini (Eds.), *Origins of the social mind: Evolutionary psychology and child development* (pp. 383-410). New York: Guilford.

MacWhinney, B. (2002). Language emergence. In P. Burmeister, T. Piske, & A. Rohde, (Eds.), *An integrated view of language development – Papers in honor of enning Wode* (pp. 17-42). Trier: Wissenshaftliche Verlag.

MacWhinny, B. (2001). The competition model: the input, the context, and the brain. In P. Robinson (ed.), *Cognition and second language instruction*.(243 - 270) Cambridge: CUP.

MacWhinney, B. (1998). Models of the emergence of language. *Annual Review of Psychology*, *49*, 199-227.

MacWhinney, B. (1994). The dinosaurs and the ring. In R. Corrigan, S. Lima, & M. Noonan (Eds.), *The reality of linguistic rules* (pp. 283-320). Amsterdam: John Benjamins.

MacWhinney, B. (1989). Competition and connectionism. In B. MacWhinney, & E. Bates (Eds.), *The crosslinguistic study of sentence processing*. Cambridge: Cambridge University Press.

MacWhinney, B., Bates, E., & Kliegl, R. (1984). Cue validity and sentence interpretation in English, German, and Italian. *Journal of Verbal Learning and Verbal Behavior*, *23*, 127-150.

Mitchel, R., & Myles, F. (2004). *Second language learning theories*. London: Arnold.

O'Brien, G., & Opie, J. (2002). Radical connectionism: Thinking with (not in) language. Language and Communication, 22(3), 313-329.

O'Grady, W., Lee, M., & Kwak, H. Y. (2008). Emergentism and second language acquisition. In W. Ritchie, & T. Bhatia (Eds.), *Handbook of second language acquisition*. London: Emerald Press.

Poersch, J. M. (2005). A new paradigm for learning language: Connectionist artificial intelligence. *Linguagem & Ensino*, 8, 161-183.

Thomas, M. S. C., & Karmiloff-Smith, A. (2002). Modeling typical and atypical cognitive development: Computational constraints on mechanisms of change. In U. Goswami (Ed.), *Blackwell handbook of childhood cognitive development*. (pp. 576-599). Malden: Blackwell Publishers.

Troike, M. S. (2005). *Introducing second language acquisition.* New York: Cambridge University Press.

Waring, R. (2008). *Connectionism and second language vocabulary*. Retrieved from http://www.fltr.ucl.ac.be/fltr/germ/etan/bibs/vocab/connect.html

White, R.V. (1988). *The ELT curriculum: Design, innovation and management*. Oxford: Basil Blackwell.

Tables

Table 1. Language syllabus design: Two Types (Extracted from White, 1988, p. 44)

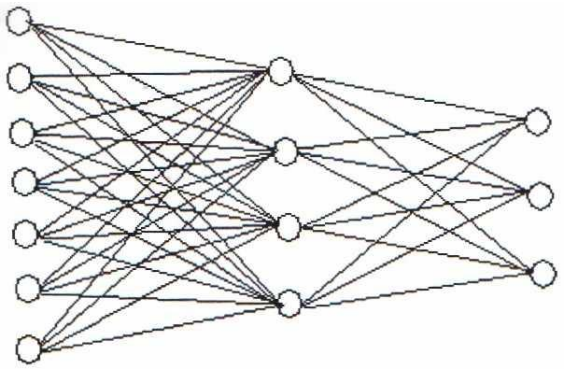
Type A: What is to be learnt?	**Type B: How is it to be learnt?**
Interventionist	Non-interventionist
External to the learner	Internal to the learner
Other directed	Inner directed or self fulfilling
Determined by authority	Negotiated between learners and teachers
Teacher as decision-maker	Learner and teacher as joint decision makers
Content = what the subject is to the expert	Content = what the subject is to the learner
Content = a gift to the learner from the teacher or knower	Content = what the learner brings and wants
Objectives defined in advance	Objectives described afterwards
Assessment by achievement or by mastery	Assessment in relationship to learners' criteria of success
Doing things to the learner	Doing things for or with the learner.

Table 2. *A comparison between traditional symbolic view and connectionist view*

Traditional symbolic view	*Connectionist view*
1. Language is rule-governed. 2. Language is viewed modular and language learning is seen as mastering the modules. 3. A distinction is made between competence and performance. 4. There is a central executive in the mind to control the processing. 5. Processing is serial and linear. 6. Higher cognitive functions (such as memory) take place in the mind. 7. Modeling is done through algorithm.	1. Language is only based on construction of associations (Gasser, 1990). 2. Language learning is the same as learning other types of knowledge or skills (Jacobs & Schumann, 1992; Mitchel & Myles, 2004). 3. No distinction is made between competence and performance (Winograd, 1983 as cited in Gasser, 1990). 4. Control is distributed among the parts of the network (Gasser, 1990). 5. Processing takes place simultaneously (Andrade & May, 2004; Hadley, 2003). 6. Higher cognitive functions (such as memory) are not discussed (Poersch, 2005; Waring, 2008). 7. Modeling is done through neural networks (Poersch, 2005).

Figures

Figure 1. Three layers of units/nodes in a connectionist network (Stanford Encyclopedia of Philosophy online, 2008)



Input units **Hidden units** **Output units**