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Age and Second Language Development: A Critical Study

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Abstract- *This paper aims to focus on the critical analysis of theoretical and the basic empirical findings in the light of Age and Second Language Development (L2D). Both behavioral and brain-based results are shown in the contexts of background and terminology, age of acquisition, critical period hypothesis, age effects, native attainment, evidence of non-nativelikeness, age and nativelikenss in the brain-based results, the aging brain, cognitive considerations, affective considerations, brain volume, and dopamine mechanism among children and adults. Suggesting beyond the classical judgments of "deficient" L2 development, this paper highlights the complimentary issues of learner potential in post-adolescent L2D.*

Key Words- *Age and Affective Considerations; Age and Cognitive Considerations; Aging Brain; Age of Acquisition; Age and Dopamine Mechanism; Nature of Age Effects in L2D*

1. INTRODUCTION

The outcome of second language development (L2D) among adults is different in many ways from the outcome of the first language development (L1D) among children. Departing from this underlying observation, researchers attempt to realize the various sources of age-related effects in L2D. This presentation is an overview of facts and theoretical issues through age and L2D. The review includes findings and controversies in the contexts of background and terminology, age of acquisition, critical period effects, age effects, native attainment, evidence of non-nativelikeness, age and nativelikeness in the brain-based results, the aging brain, cognitive considerations, affective considerations, brain volume, and dopamine mechanism among children and adults.

1.1 Background and Terminology

Over the past 20 years or more, a lot of empirical investigation over the age issue in L2D has been expressed the end state of L2D. The development literature and comparative rate (adults vs. children) literature are certainly not without interests, and overviews of this research can be observed in Klein (1995)[19], Marinova-Todd, Marshal, and Snow (2000)[29], and Pienemann, Di Biase, Kawachi, and Hakansson (2005)[36].

It is essential to know that the end state receives its share of attention because it is proved from the end state that indicates the upper limits of L2D. Both as a matter of logic and of theoretical adequacy, it is significant to note that while comparing L1D and L2D, a superficial difference in ends does not imply an underlying/basic difference, nor does the similarity of ends imply similar process. With respect to the question of Universal Grammar's (UG) mediating role in L2D, we can assume that nativelikeness in the L2D end state does not imply access to UG.[11] Researchers must be wary of linking end-state differences in L1D and L2D to a loss of common learning capability or to some erosion of any putative mechanism is responsible for successful L1D.

In literature, the terms end state symbolizes final state, steady state, ultimate attainment, and asymptote refer to the outcome of L2D. Let us note that "ultimate development" has been used as a synonym for nativelike proficiency. However, the term refers to the final product of L2D. Researchers have explored several biological variables that can be predictive of L2D results. Age of acquisition (AoA) is realized as the age by which learners are involved in the L2 perspective, typically as immigrants. This landmark is different from the age of first exposure (AoE), which can happen in a formal schooling environment, visits to the L2 country extended contact with the relatives who are L2 speakers. Researchers intend to equate the terms late L2D, post-adolescent L2D[22] (i.e. growing from childhood to maturity; between puberty and full maturity.), and post-pubertal L2D (i.e. the beginning of sexual maturity); these are typically occurred as AoA of >12 years. Length of residence (LoR) refers to the amount

[11] Innately specified linguistic knowledge given by UG is posited to account for the apparent gap between learners' knowledge of linguistic structure and what they have been exposed to in the linguistic input (e.g., Chomsky, 1975). In late L2A, learners have access to fully developed linguistic representations in their L1.

[22] These figures are expressed as absolute values because some experiments correlate AoA with numbers of errors or degree of foreign accent—thus resulting in positive correlation coefficients—whereas others correlate AoA with numbers of correct items or degree of nativelike accent—thus yielding negative correlations.

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of time spent in the L2 context. Other experimental variables include amount of formal training in the L2 as a foreign language (i.e. grammar courses, corrective phonetics) as well as the amount of exposure to the L2, where non-natives are enrolled in high school, vocational, or university classes in the L2 country. Endogenous (i.e. increasing by internal growth of depression with no external cause.) variable of interest to L2D researches include the following: motivation (e.g. motivation to pass for a native, motivation to acquire lexico-grammatical accuracy), psycho-social integration with the L2 culture, aptitude (imitative ability, working memory capability, meta-linguistic consciousness, etc.), and learning styles and strategies.

2. AOA AND L2 ULTIMATE DEVELOPMENT

It is broadly accepted that AoA is predictive of L2D outcomes, in the common sense that AoA is found to have connected negatively with acquired L2 at the end state. The areas of language generally investigated are morpho-syntax and pronunciation. Typically, morpho-syntax errors in grammatical judgments widen with advancing AoA . Statistics shows that determine AoA and other clues can be connected to L2 success. AoA is pertinently the powerful prognosticator of fundamental development. In many cases, variables like LoR and AoE are governed as factors in the experimental design.

3. AGE AND NATIVELIKENESS IN BRAIN-BASED RESULTS

As a fulfillment to linguistic and meta-linguistic result, brain-based testimony enlightens significant measurements of the issue of age and L2D. A number of recent retrospect has given more breath and depth to the discussion of pertinent research than space allows here (Abutalebi, Cappa, & Perani, 2005[1]; Indfrey, this volume; Stowe, Sabourin, Green, & Paradis , 2005)[48].

4. THE CRITICAL PERIODS HYPOTHESIS

The critical period hypothesis states that there is a period when language development occurs naturally and effortlessly. Penfield and Roberts (1959)[33] argued that the optimum age for language development falls within the first ten years of life. During this period, the brain retains plasticity, but with the onset if puberty this plasticity starts to vanish. Both critics suggested that it is the result of the lateralization of the language function in the left hemisphere of the brain. That is the neurological capacity for understanding and producing language, which initially involves both hemispheres of the brain, is slowly concentrated in the left hemispheres for the most people. The increased difficulty which older learners supposedly experience was seen as a direct result of the neurological change.

Some evidence to support the critical period hypothesis was applied by Lannberg (1967)[22]. Lannberg observed that injures to the right hemisphere caused more language problems in children than in adults. He also saw that in case of children who underwent surgery of the left hemisphere, no speech disordered results, whereas with adults almost total language loss occurred. Moreover, Lannberg provided evidence to show that whereas children rapidly recovered total language control after such operations, adults did not do so, but instead continued to display permanent linguistic impairment. This suggested that the neurological basis of the language in children and adults was different.

Lennberg's evidence does not demonstrate that it is easier to acquire language before puberty. In fact, Lennberg assumed that language development was easier for children. The critical period hypothesis is an inadequate account of the role played by age in L2D, because the assumption was partially correct, where pronunciation is concerned in an early start and advantage, and even in terms of success, not rate of development. The critical period hypothesis needs to be recast to account for why loss of plasticity affects pronunciation but no other level of language. There are multiple critical periods (Seliger1978). The process of lateralization and localization of language functions is a gradual one by carrying over many years. Different aspects of language are affected at different stages in this process. This explains why adolescents outperform adults in grammar acquisition- around sixteen a critical period affecting grammar can be reached. In general, the evidence linking cerebral dominance and age differences in learners is not clear.

5. THE AGING BRAIN

The next descriptive element of age and L2D comprises of facts regarding the maturing brain, by which the accounts of age-related differences in fundamental development must be congruous. Neuro-cognitive characteristics of maturing are liable to investigation at various organizational and analytic stages. Those pertinent to language development include the systematic stage (lexicon encoding and retrieval, processing speed and depth, connection and co-ordination of grammatical units in real time, etc.), the learning stage (Hebbian learning, declarative memory and procedural memory, etc.), the brain structure level (hippocampus, striatum, etc.), and the cellular stage (neurotransmission, regional volumetric decrease, neuro-genesis, etc). The basic consideration is the degree and locus of age effects in many levels of analysis.

6. AGE AND COGNITIVE CONSIDERATIONS IN L2D

Human cognition develops swiftly throughout the first 16 years of life and less rapidly thereafter. Some cognitive changes are critical; others are more gradual and difficult to avoid. Jean Piaget 1972; Piaget & Inhelder 1969[35]

outlined the course of intellectual development in a child through different stages: (a) Sensorimotor stage (birth to two), (b) Preoperational stage ,(ages two to seven) (c) Operational stage (ages seven to sixteen), (d) Concrete operational stage (ages seven to eleven), and (e) Formal operational stage (ages eleven to sixteen). A critical stage for a consideration of the effects of age on L2D appears to occur, in Piaget's outline at puberty (age eleven in his model). A person becomes capable of abstraction, and of formal thinking which transcends concrete experience and direct perception. Cognitively, a strong argument can be made for a critical period of L2D by connecting language development and the concrete/ formal stage transition.

According to Ausubel, adults learning a L2 may profit from grammatical explanations and deductive thought for a child pointlessly. Adults do profit from such explanations depending on the suitability and efficiency of the explanations, the teacher, the context, and other pedagogical variables. The researcher is of the view that children learn L2 without benefit or hindrance of formal operational thought.

Young children are not "aware" that they are acquiring a language, nor are they aware of societal values and attitudes placed on one language or other. Is it possible that a language learner who is not conscious of what he or she is doing will have difficulty in developing a L2? Anecdotal evidence shows that some adults who have been successful language learners have been aware of the process they are going through, even to the point of using self-made paradigm and other fabricated linguistic device to facilitate the learning process. If mature cognition is a liability to successful L2D, clearly some intervening variables allow some persons to be successful L2D learners after puberty.

According to Rosansky (1975)[41], cognitive development accounts for the greater ease by which children learn language. She comments that L2D can take place in two different ways, according to whether, or not the learner is aware of what he is doing. The child sees only similarities, lacks flexible thinking, and is self-centred. These are the pre-requisites of automatic language development, because associated with them is an absence of meta-awareness. The young child does not know that he is developing language. Moreover, the child has not developed social attitudes towards the use of one language as opposed to another. In contrast, adults can not learn a L2 automatically and naturally. The problem with Rosansky's arguments is the same as that of the neurological explanations. They are both based on the false assumptions that post-puberty learners are less efficient and less successful than younger learners. Cognitive development can help to explain why adults learn rapidly than children.

7. AGE AND AFFECTIVE CONSIDERATIONS IN L2D

Human beings are emotional creatures. Meaning as well as action is emotional. As "intellectual" beings, we are influenced by our emotions. It is logical to look at the affective considerations for the important answers to the problems of contrasting the differences between L1 and L2 development.

Research on the affective consideration in L2D has been mounting steadily for a number of decades. Linguistic theory is now asking the deepest possible questions about human language, with some applied linguistic examining the inner being of the person to discover if there lies an explanation to the mystery of language development. The affective consideration includes empathy, self-esteem, extroversion, inhibition, imitation, anxiety, and attitude. Some of these may seem at first rather removed from language learning, but when we consider the pervasive nature of language, any affective factor can be pertinent to L2D.

Brown (1980) proposes that L2D is related to the stages of acculturation (i.e. the ability of the learner to relate and respond easily to the foreign language culture). Brown identifies four stages of acculturation: (1) initial excitement and euphoria; (2) culture shock, leading to feelings of estrangement and hostility towards the target culture; (3) culture stress involving a gradual and vacillating recovery; and (4) assimilation or adaption to the new culture. Brown argues that stage is the crucial phase. Young children are seen as socio-culturally resilient, because they are less culture-bound than adults. They move through the stages of acculturation more quickly and acquire the L2 more quickly. The major problem with Brown's theory is once again the false assumption that children are the more rapid learners.

Neufeld (1978)[32] offers a more convincing account of how affective factors are related to age differences in L2D. He distinguishes 'primary' and 'secondary' levels of language. Primary levels include a reasonably large functional vocabulary, and basic mastery of pronunciation and grammatical rules. Secondary levels include the ability to handle complex grammatical structures and different language styles. All learners, according to Neufeld, have an innate ability to acquire primary levels. However, children are more likely to achieve secondary levels than adults because they are much strongly motivated by the necessity to be accepted by their peer groups. Whereas the adult is happy to maintain a foreign accent, for example, a child who is exposed to the first language culture is anxious to achieve native-like pronunciation.

8. AGE, BRAIN VOLUME AND L2

In this study, we may focus on the feasibility of a connection between brain volume declines in maturing and lessens in L2 development. The volume lessens are known to start in the adulthood that whether there is a link between brain volume and L2D, it can be a biological demand in nature, but not full-aged. The brain volume declines with proceeding age. The shrinkage differs from brain structure to brain structure. In all matters investigated, the decreases, once commenced, are

conventionally lineal and are persistently continual, with no staging off to the end.

At the very outset of investigation, a gray matter volume decreases in a lineal fashion starting in boyhood. (Pfefferbaum et al., 1994[34]; Courchesne et al., 2000) on the contrary, a white matter volume rejoices a lineal growing unit at an early maturity. A resulting plateau turns into the seventies, after which there is a lineal lessen into the fully matured age. Let us have a look at fixed regions of interest; the issue resulting from a great deal of investigation is provided that the volumes of several stages of the brain are influenced by age than others. The answer to this question is not clear cut as different outcomes are achieved by various investigation strategies and in lengthways and cross-cutting investigations, with the underestimating the amount of shrinkage. An apparent image of age-connected decrease in regional brain volume was proposed by Raz (2005)[38] in his investigation of pertinent research. Outcomes of cross-cutting statistics show that the fields influenced by age are prefrontal brain/cortex. In the longitudinal statistics, we can see that the four stages most impressive to volume decreases are entorhinal cortex, the hippocampus, the caudate nucleus, and the frontal lobe all with less than 1% annual decreases. Moreover, these data regard the outcomes of the Raz et al. (2003) study of 53 healthy adults between the ages of 20 and 77 years. Highlighting the striatum, the researchers observed that the caudate nucleus volume decreased at .83% each year, the putamen at .73% each year, and the globus pallidus at .51% each year. The contraction started in young maturation. The observed declines were lineal; the same rate of decrease was found for younger and older subjects. Most statistics do not express the epochs at which decreases commence; and at which the slopes are most dramatic. Raz removed through the pertinent statistics to come to a new realization regarding object and geometry of declines. Firstly, volumes of the caudate nucleus, cerebellum, and cortical structure decline in a linear fashion that starts with adolescence and continues throughout the life span. Secondly, the entorhinal cortex and hippocampus seem to become a greater annual contraction than other stages of the brain. These decreases tend to start in middle age to old age in the case of the hippocampus, and in older age for the entorhinal cortex.

Whereas the relationship between brain volume and maturing is lineal and uncontrolled the relationship between brain volume and perceptive declines is not linear in many ways. It has been proposed that perceptive deficits begin to be revealed after structural devastation arrives a certain threshold, but not before (Raz, 2000, p.65) As a result, it is stimulated to connect the regional morphological changes to specific perceptive deficits which can be connected to L2 development.

Two studies illustrate the challenges exposed by this kind of research. Golomb et al. (1994)[17] observed that decreases in hippocampus volume predicted performance decrements upon delayed memory tasks (e.g., list recall, paragraph recall, and paired associates). On the contrary, Reuter-Lorenz (2000)[40] saw that volumetric decreased in the temporal areas were not paralleled apparently by performance decrease in associative memory.[33] Given the present state of research, the mist excellent investigation to be created is that neural resources, for which the regional brain volume is a proxy, are good predictors of performance sub-served by brain areas, but not others.

9. AGE AND DOPAMINE MECHANISM IN L2

The role of the nigrostriatal dopamine mechanism in efficient motoric system activity is well known. Moreover, DA seems to be entangled in higher order perceptive activities, many of which are implied in language learning and development, such as attention, motoic sequence, and working memory (Backman & Farde, 2005)[3].

Schumann et al. (1997, 2001, 2004)[43][44] argued that DA is entangled in fundamental ganglia activities in L2D, some of which are involved in motivation to learn and learning reinforcement. These systems are considered to achieve to proceduralization (i.e., the creation and empowering of linguistic rules; Lee, 2004, pp.66-67[21]). The outcomes of study by Tiechmann et al. (2005)[50] of Huntington disease patients reinforce the concept that the striatum is entangled in the systems of rules as opposed to phrases. Crosson et al. (2003)[14] considers for a role of the basal ganglia in a variety of language production system at the stages of syntax, lexicon, and phonology.

Dopamine is thought important to defossilization, an undoing of automatized linguistic performance. Similarly, DA-mediated systems are entangled in lessening L1 affect; for instance, one can visualize in the role of DA by suppressing and supplanting L1 routines in syntax and routines in phonology.

In humans, D1 and D2 receptors are allotted throughout the neocortex. Damage to the DA mechanism in humans occurs in deficits in executive function, verbal fluency, and perceptual velocity. Both D1 and D2 receptors seem to be implied in working memory modulation. Models of DA function accumulate on the thought that DA facilities switching between attentive targets both within and between neural networks, with the effects of beautifying the ratio of incoming neural signal to background noise. For a review of effects on the perception of age-related alters in nigrostriatal DA.

Li and Sikstrom (2001)[23] observed that decreases in D2 receptors start up the twenties and continue across life span. These decreases are found not only in the BG but also in the hippocampal fames, frontal cotex, anterior cingulate cortex, and amygdale. Of particular interest is the proposition by Li et al. (2001) that the maturing age and

[33] Associative memory is essential to connectionist accounts of language acquisition and use and to the representation and processing of irregular forms under the words-and-rules approach (e.g., Pinker & Ullman, 2002) in both L1 and L2 (Ullman, 2001).

DA loss, neural noise enlarges, resulting in less distinctive neural representations. The decrease is connected to age-related perceptive deficits across domains, including working memory and executive function (Backman & Farde, 2005, p.61)[3].

A few PET studies have looked at age-related decreases in DA markers and declarative perceptive decreases. A familiar pattern of results emerge from studies: Declines start in twenties and continue throughout life span. A representative study is that of Volkow et al. (1998)[52], who determined by PET the striatal D2 combining potential in matured age 24-86 years. Behavioral measures included executive, motors, and eternal speed. D2 receptor combining lessened with maturing age in the caudate nucleus (r=-62) and putamen (r=-7); similar correlations were achieved between age and task performance. Thus, with the respect to the geometry and timing of DA age gradient and in terms of the perceptive functions mediated by DA, we can assume that DA declines are reasonable systems underlying age effects in L2 development. A similar conclusion applies to stress – and age-related increases in cortisol by being connected hippocampal atrophy (Lupien et al., 1994, 1998)[24][25]. With the adjustment in the temporal and geometric characteristics of age –related declines, as the case was with respect to brain volume decreases, the feasible linkage to L2D of alterations in dopamine, estrum and acetylcholine metabolism (Freeman& Gibson, 1998)[16] is understood to be biological in nature, but the changes do not start unless maturation is ruled out.

10. NATURE OF AGE EFFECTS IN L2D

In literature, we find a multiplicity of candidate causal methods-biological and experimental – and mediating factors-endogenous and exogenous –that underline age realities in L2D.Singleton (2005)[47] saw no less than 14 versions of the critical period hypothesis as it applies to L2D.Birdsong (1999[6] cited six major variants of L2D and pointed to numerous endogenous and exogenous factors that influence ultimate development in L2. MacWhinney (2005)[27] identifies 10 “concrete proposal” in the literature that connect AoA to ultimate L2D, and to these were added two explanations for variability in L2D outcomes. The various hypothesized systems connect to the biology of the species, developmental sides of perception, L1 affect, use of the L1 and L2 and psycho-social/ affective dimensions of the personalities, including a person’s motivation to learn, seem nativelike, or integrate into the L2 culture.

There is an understandable sensibility in discussions of the underlying sources of age effects in L2 learning to isolate a single mechanism, or to focus on one type of mechanism. This practice simplifies the phenomenon in question and polarizes stances on a textured set of issues. It is more reasonable to take the primary position that the identified factors and systems which are not at odds with experienced findings are potentially at work in some fashion in L2D. Some might account for more variance than others, and individual differences in L2 development. Some factors trump others; for instance, it is pointless to invoke neurobiological abilities in the contexts of an individual who has no interest in passing for a native (Klein, 1995, Moyer, 2004; Piller, 2002).

Ongoing research in L2 development must account not merely for the typical decrease in L2 development with age but also for the nativelikeness those late learners are able to require clear-eyed and open-minded steps to integrate biological, perceptive, experimental, linguistic, and affective dimensions of L2 learning and development.

11. USE OF EVIDENCE OF NON-NATIVELIKENESS

The relevance to L2D theory of behavioral evidence shows end-state nativelikaness and non-nativelikeness. Now let us consider small quantitative differences between the L2 and native L1 (i.e. shorter than native norm voice onset time [VOT] values averaged over subjects). In bilingualism, L2 VOT values tend to move toward L1 VOT values; at the same time, L1 VOT values of bilinguals move toward L2 values (Flege & Hillenbrand, 1984[15]; Mack, Bott, & Boronat, 1995[26]). L2 effects in the L1 have been observed in such diverse domains as collections (Laufer, 2003)[20], moddle voice constructions (Balcom, 2003)[4], syntactic processing (Cook, Iarssi, Stellakis, &Tokumaru, 2003)[12], and lexical decision (Van Hell & Dijkstra, 2002)[51]. Rather than invoke deficiencies in learning, it is more reasonable to argue that minor quantitative departures from monolingual values are artifacts of the nature of bilingualism, wherein each language affects the other, neither is identical to that of a monolingual.

12. NATIVELIKE ATTAINMENT IN LATE L2D

Historically, research in L2D has been guided by what has been termed the *deficit model*. Characterizing the end state of L2D as a “lack of success,” research in the tradition looks to explain the “near-universal failure” of adults to reach attainment comparable to that observed in L1A (Bley-Vroman, 1989)[8]. The prevailing view was that nativelikeness was so rare as to be of no relevance to L2A theory (Bley-Vroman; Selinker,1972)[8]. Estimates of a 0-5% incidence of nativelikeness were more a matter of guesswork than experimentation and might have referred to a population that included the foreign language learners who were not at the L2D end state. However, a number of studies have targeted immigrants with sufficient LoR (length of residence) and contact with natives to qualify for end-state status and have attempted to ascertain the rate of nativelikeness in the sample. The findings of these studies suggest that nativelikeness in late L2D is not typical, but also exceedingly rare.

Anecdotal evidence, along with some research, suggests that nativelikeness is attested less in the domain of

pronunciation than in other performance domains. However, nativelike pronunciation is not impossible, as studied by Birdsong (2003)[7], Bongaerts and colleagues have shown. The perceptual abilities underlying unaccepted L2 pronunciation have proved to be amendable to training in some studies (Bradlow, Pisoni, Akahane-Yamada, & Tohkura, 1997; McCandliss, Fiez, Protopapers, Conway, & McClelland, 2002)[30] but resistant to training in others (Takagi, 2002)[49].

13. CONCLUSION

From the cognitive literature, we can assume that the associative memory and incremental learning elements of language development are compromised by age, as are the working memory of language development. It seems that these declines are linear, and they start with an early adulthood and continue throughout the whole life. SLD is less automatic among non-L2-dominants, and less efficient than L1D. As increasing demands are made on a finite-capacity fundamental system, performance declines are to be expected. For some areas of the brain, we see some evidence of linkages between age-related morphological changes and the cognitive processing mediating L2 learning and development; for instance, age-related declines in working memory attention, and speed of processing appear to be correlated with the volumetric declines in the frontal lobe and prefrontal cortex, the latter area is susceptible to the effects of aging. A stronger case can be made for the relation of age-related dopamine declines to a variety of cognitive deficits that can undermine L2 development. As for the timing of changes in the aging brain, none of the evidence from the cognitive, brain volume or dopamine literature is consistent with a maturation account because the observed declines begin after the end of maturation.

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