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seems easier since they do not have to switch the L1 parameter to L2 parameter while for varying violations this might be one possible justification for their relatively poor performance.

Moreover, the higher variability of groups 2 and 3 compared with lower variability of group 1 and the native speakers confirms that the late learners have diverse approaches in dealing with UG violations.

Implications of the Study

The implications of this study are twofold: theoretical and pedagogical. Theoretically speaking, this study tried to check if the nature of hypothesized critical or sensitive period extends to second language. Results demonstrated a clear and strong advantage for early learners over the late learners.

Another important theoretical implication of the study is the highest variability of the third group and considerable variability of the second group implying that late learners approach L2 through different routes.

The main pedagogical implication of this study is that to achieve native like performance, SLA should start as early as the first decade of life. The decision about a very precise age of onset needs a lot of further research and depends on plenty of other factors. Moreover, the higher variability of the third group and the conjecture that they go through different routes in learning L2 implies that an identical teaching method is not advisable.

Generally speaking, the results of the study show a very powerful adverse effect of the increase of onset age on the ability of the learners to detect UG violations. In addition, age differences were also important in that group 1 always performed as well as the native speakers; group 2 could not perform as well as the native speakers in most cases: in detecting total violations, varying violations, invariant violations and cluster sub-test ; group 3 failed to perform as well as the native speakers and group 1 in any of the issues under investigation. Group 3 could not perform as well as even group 2 in structure dependency sub-test. We can conclude that (a) the ultimate level of attainment depends in part on the onset age; (b) there are sensitive periods controlling language development during which the acquisition of different linguistic properties is fruitful and after which language learning becomes irregular and incomplete; (c) the age-related loss in competence is cumulative and there is no cut off point (Long, 1990). The deterioration in some learners occurs as early as the beginning of second decade of life. The results of this study support the finding in the literature that capacity for language development is maturationally constrained (Johnson and Newport, 1991).

Another conclusion of this study is that since late learners did not perform as well as the native speakers on both violation types, age of acquisition affects both varying and invariant UG type knowledge. Late learning damages the acquisition of both; however, detecting invariant violations

indicated that the four groups perform significantly differently on this sub-test ($F(3,97)=12.65, p<.05$). The following Scheffe tests showed that group 1 is not different from groups 2 and 4; however, groups 1, 2 and 4 are different from group 3 implying that after the age of 16 the subjects find instances of structure dependency difficult to grasp. A second important point about the Scheffe-test results is that group 2 is different from group 3, as groups 1 and 4 are different from it. This implies that those starting L2 in the second decade of life might not encounter much difficulty in dealing with instances of structure dependency while late learners who start L2 after 16 will most probably face difficulties even in rudimentary aspects of UG.

Cluster Sub-test

ANOVA results showed a group difference for Cluster sub-test ($F(3,97)=10.33, p<.05$). Scheffe-test results revealed that groups 1 and 4 are significantly different from group 3. However, group 1 is not different from group 2 while group 4 is different from group 2 implying that group 2 is not different from group 1 but cannot perform as well as the native speakers. This sub-test is not a main part of the test and cannot be given that much credit since there is only one item for each violation type. As was mentioned earlier the main purpose behind including this sub-test is to provide distractors.

Summary and Conclusion

consider it as unacceptable as instances of extractions from SS, RC and NC. To a lesser extent, the case is true with extractions from EQ. Native speakers are not so determined about the unacceptability of extractions from EQ. The mean scores for the fourth group, the native speakers, on the five structure types: TTE, EQ, SS, RC and NC are 19.75, 21.20, 24.00, 23.50 and 23.30 respectively. As you see the scores for TTE is the least and EQ is the second least detected violation, that is why even for native speakers the sum of scores on varying violations is lower than the sum of scores on invariant violations.

As for the varying structures, the four groups follow a similar pattern on the two varying structure types, TTE and EQ. However, for the four groups we have lower scores for TTE, meaning that it is a less detectable violation, though the interpretation might be different for the native speakers and the three groups of L2 learners. As for the invariant structures, the general conclusion here would be that irrespective of the kind of structures in the invariant violation type, the gradual increase of the onset age of second language learners leads to decline in detection of UG violations even in a natural L2 environment.

Structure Dependency

Since in Persian, formation of interrogative needs no movement, the next question examined was whether subjects with different onset ages were able to observe structure dependency in English. Results of ANOVA

L1 parameter to L2 parameter and invariant violations are easier since they follow the same parameter in both languages.

Figure 2 below shows how the four groups differ with regard to the five structure types.

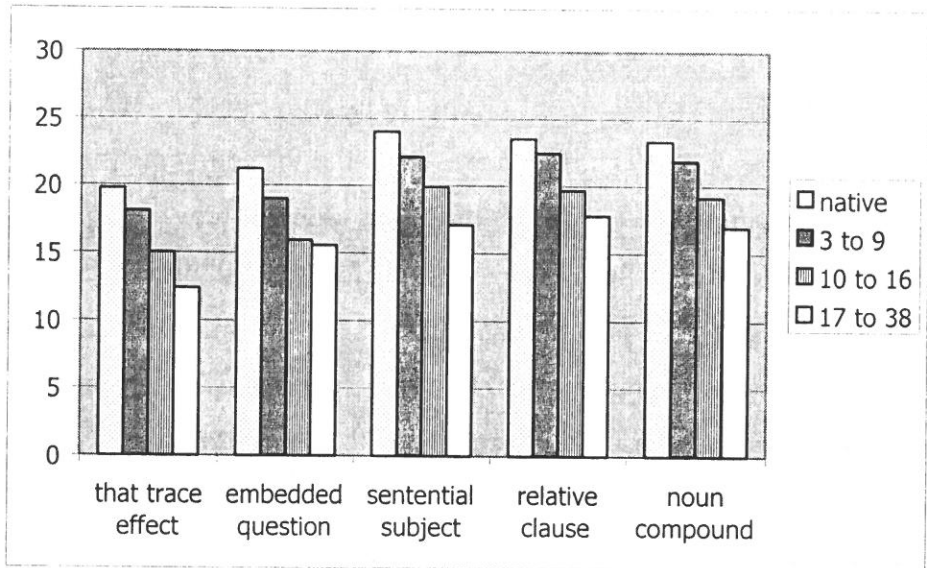


Figure 2. Means of each UG violation type in the four groups

For the four groups, the scores on varying violations, TTE and EQ, are lower than the ones on invariant violations. That the scores are lower for the three age groups is not surprising but “how can we interpret the scores for the native speakers?”

The point is that the native speakers do not unanimously agree about unacceptability of instances of That-trace Effect. Many of them do not

significant effects on subjects' scores. However, the interaction of age group and violation type ($F(3,94)=.477, p>.05$) is not significant. Later on, two separate one-way ANOVAs were conducted to see how different the four groups are on each of the violation types. The results showed that in both violation types, the groups are significantly different from each other (varying type of violation ($F(3,94)=15.48, p<.05$); invariant type of violation ($F(3,94)=16.99, p<.05$). The following Scheffe Test results showed that the pattern of difference is the same for both violation types. In both types, group 1 is different only from group 3; however, group 4, which is not different from group 1, is different from groups 2 and 3 implying that group 2, which is not that different from group 1, cannot perform as well as the native speakers. Therefore, the general conclusion is that L2 learners whose onset age passes the second decade of life do not achieve the same performance in L2 as first-decade learners. The latter are in the best position to learn L2 in a manner very close to the native speakers. T-tests were run to see if subjects deal with the varying and invariant violation types differently. The results showed that the four groups had different treatments with the two violation types. Since in each group the mean scores for the varying type is lower than that for invariant type (Table 2), it is inferred that invariant violations have been easier to detect. The implication of this finding for the PLESL might be that varying violations are harder to detect since they have to switch the

effect on the performance of the subjects ($F_{(3, 94)}=19.33, p<.05$). Scheffe-test results showed where the difference lies. Only group 1 performs like group 4, meaning that the 3-9-year olds perform like native speakers. Group 1 and 4 are different from groups 2 and 3 confirming that late learners lag behind early learners in detecting the violations. Since groups 2 and 3 are not different, it is inferred that with the start of the second decade subjects' ability to access UG decreases.

Varying vs. Invariant Violation Types

In this section, subjects' performance on each of the two kinds of violation is analyzed in detail. Descriptive statistics for the four groups' mean scores on both violation types are presented in Table 2.

Table 2. Descriptive Statistics for the Four Groups' Mean Scores on Varying and Invariant Violation Types

Violation type	Varying structures		Invariant structures	
	Mean	SD	Mean	SD
Age Group				
1 (3-9)	55.63	7.60	66.45	5.9
2 (10-16)	46.43	13.11	58.75	9.37
3 (17-36)	41.90	13.49	52.12	14.33
4 (native)	61.42	6.22	70.8	5.06
Total	50.08	13.33	60.77	12.36

The results of Repeated-measures ANOVA indicated that both violation type ($F(1,94)=147.04, p<.05$) and age group ($F(3,94)=19.23, p<.05$) have

negatively affects the total scores of the subjects on the five structure types, the range of onset age is between 3 and 36 and that of the total scores is between 25 and 125.

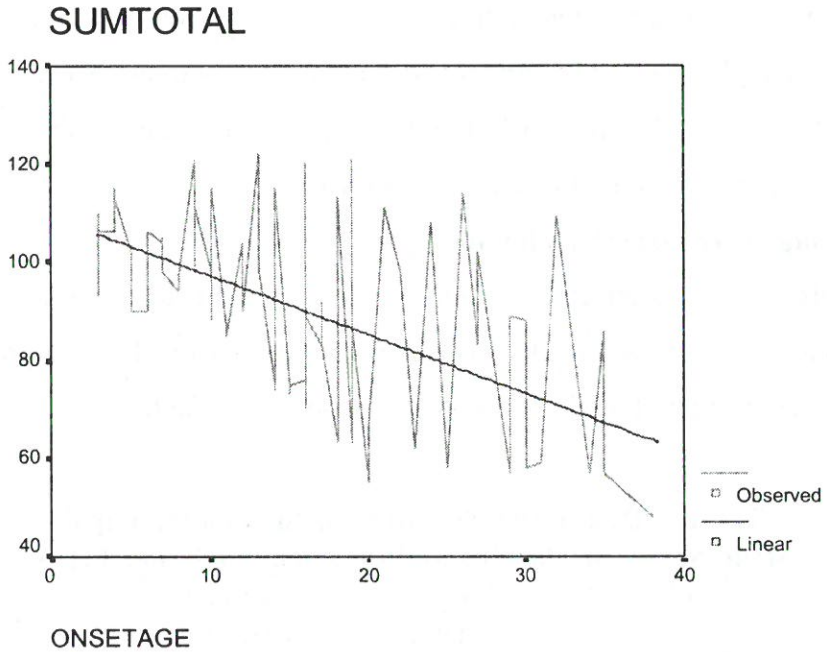


Figure 1. The negative effect of the increase of onset age on total scores

UG Violations

The question attempted in this part is to see if age group has any impact on knowledge of UG violations, including the variant and invariant ones. As the results of one-way ANOVA indicated, group has an important

Results and Discussion

The first question examined in this study is whether there is any relationship between the subjects' onset age and their performance on the different UG violations. The results (Table 1) showed a negative correlation between onset age as an independent variable and the five structure types which are instances of UG violation (TTE, EQ, SS, RC and NC). Thus, the increase of onset age has an adverse effect on the performance of the second language learners. This is also true for the relationship between onset age and the other two sub-tests: Cluster and Structure Dependency.

Table 1. Correlations between Onset Age and the Violation Types and the Two Sub-tests

	TTE	EQ	SS	RC	NC	CLUS- TER	STR. DEP.	VARY- ING	INVA- RIANT
ONSET AGE	-.49*	-.40*	-.51*	-.43*	-.47*	-.38*	-.49*	-.51*	-.53*

*. Correlation is significant at .01 level.

As Table 1 shows, the increase of onset age has a negative effect on both kinds of violations: Parametrically Varying and Invariant violations. The older learners cannot detect the violations as properly as the younger ones whether the kind of violation is considered a violation in their mother tongue as well or not. Figure 1 illustrates how the increase of onset age

in some way. To eliminate the ordering effect of the test, two versions were devised with different orders of the items in each version. Moreover, in order to skip the difference between *who* and *whom*, the subjects were informed that *who/whom* distinction is not important in the test.

The Subjects

There were 78 subjects who were Persian speakers of English as an L2; 20 native speakers of English served as controls. To qualify as a second language learner in this study, subjects' arrival in Canada, and consequently their first immersion in the English language, had to occur at least at the age of three. Moreover, the subjects had to have sufficient exposure to English to be considered at their ultimate attainment state. The requirement of minimum years of exposure in this study (following Oyama, 1978; Johnson and Newport, 1989, whose studies showed no effects of length of exposure for adult learners of an L2 after 5 years of exposure) was taken to be 5 years before the time of test. However, a syntax test is also devised. Subjects who had under five years of exposure to English or could not pass the syntax test (the criterion was to get 16 out of 20) were excluded. The subjects in this study were categorized based on their onset age. 22 subjects, 3-9 years old, comprised group 1. 24 subjects, 10-16 years old, belonged to group 2; and 32 subjects, 17-36 years old comprised group 3. 20 native speakers acted as controls.

question marker “*aya*” at the beginning of the sentence, the relevant information cannot be transferred from Persian to English. Subjects were asked to transform five statements, each including a relative clause, into interrogative forms.

In addition to the three sub-tests of subjacency (20 items), ECP (5 items) and structure dependency (5 items), there was a cluster of 11 sentences with UG type violations which are specific to English and are not considered violations in Persian. This cluster serves two functions in this study: as distracters and a separate sub-test.

A syntactic sub-test was also included in the test to make sure that the subjects have the linguistic knowledge about the structures under investigation. The four syntactic structures, each consisting of four grammatical sentences, include: sentential subjects, relative clauses, noun compounds and embedded questions, each of which is in italics in the following sentences:

SS: *That oil prices will rise again this year* is certain.

RC: The theory *we discussed yesterday* will be on the exam next week.

NC: There is a good possibility *that we can obtain the information elsewhere*.

EQ: The dorm manager asked me *who I wanted to have as a roommate*.

In addition, there were ten *wh* questions functioning as distracters so that the subjects would not conclude that all the *wh* questions are unacceptable

Some of these subjacency violations are considered ungrammatical both in Persian and in English. These will be referred to as *invariant* subjacency violations. However, certain wh-movements are grammatical in Persian but ungrammatical in English. These will be referred to as *parametrically varying* subjacency violations. Structures (a), (b), and (c) above, that is, SS, NC and RC, are invariant violations; while structure (d), that is, EQ, is considered as a parametrically varying subjacency violation.

2. Empty Category Principle (ECP) or that trace effect

This refers to extraction of the subject of the embedded question when *that* is not deleted:

* Who do you think *that t arrived yesterday?*

This structure is also parametrically varying between English and Persian.

3. Structure Dependency

Cook (1988) defines structure dependency in this way: “operations on sentences such as movement require a knowledge of the structural relationships of the words rather than their linear sequence” (p. 6). In English, for instance, when there is a relative clause and we want to make an interrogative *yes/no* question as in: *The man who is climbing the tree will be bitten by the snake*, the auxiliary is extracted from the main clause and not from the relative clause. Since in Persian the interrogative *yes/no* question is either made by rising intonation or by bringing the *yes/no*

This Study

Attempt is made in this study to examine if the nature of the hypothesized critical or sensitive period extends to second language acquisition. In other words, attempt is made to see if onset age has any influence on the subjects' ability to detect violations of UG principles. Before going to the details, the principles selected for this study will be elaborated.

1. Subjacency

The subjacency principle places restrictions on the type of extractions that can be made. Based on this principle, extractions from the following structures are UG type violations. The four subjacency violation types selected for this study include:

(a) Extraction from the sentential subjects (SS):

**Who was for a student to disagree with t impossible in his country?*

(b) Extraction from the noun complements (NC):

**Which paper did the professor refuse to believe the claim that someone had stolen t?*

(c) Extraction from the relative clauses (RC):

**Who did the news reporters surround the cabinet officer that had criticized t?*

(d) Extraction from the embedded questions (EQ):

**Which test don't you know who failed t?*

Thus, the focus of investigation in SLA, as White (1989a, p.44) says, is whether UG is still available in adulthood to guide acquisition which is also the issue this study will undertake to elucidate.

settings of the L1; (c) UG is accessible but only through L1 settings; (d) UG is accessible but its function is different in L1 and L2; (e) UG is not accessible in L2 acquisition. Bley-Vroman (1987) believes that UG is not directly accessible to L2 learners; rather, in SLA, L1 grammar and a 'general abstract problem solving system' replace the role of UG in L1 [see also Clahsen and Muysken (1986, 1989) who favor information processing and general-problem solving principles in L2 acquisition]. Bley-Vroman adds that even if L2 learners can determine violations of UG in grammaticality judgment test, it doesn't necessarily mean access to UG. Correctness of judgment may come from many other cognitive domains.

Schachter (1989) and Johnson and Newport (1991) suggested that whatever the nature of the endowment that allows humans to learn language, it suffers from a very thorough deterioration as learners become increasingly mature. However, there are studies showing that UG is accessible to L2 learners. White (1989a) proposes that L2 acquisition like L1 may involve the knowledge of some highly constrained principles of UG. White and Genessee (1996) claim that ultimate attainment is possible for L2 learners though they admit that they have a lower chance to reach such levels of competence.

There are some short-term studies which target only the differential rate in acquisition (they do not take ultimate attainment into account) and support the first generalization (Asher and Price, 1967; Schmidt, 1986; Olson and Samuels, 1982; Seright, 1985). However, as for the second conclusion arrived at by Krashen, Long and Scarcella (1982), there are many studies which support that older learners outperform the younger ones in rate of acquisition of morphology and syntax (Ekstrand, 1976; Snow and Hoefnagel-Hohle, 1978; Collier, 1987). However, Taha, Wood, and Loewenthal (1981b) came up with findings in apparent conflict with the second conclusion. As for the third generalization, some studies show that even after years of receiving naturalistic and/or formal exposure to the second language, adult learners cannot achieve native like proficiency in the second language. Sensitive or critical period might not be bound to phonology and it might be extended to syntax and grammar on the whole (Patkowski, 1980; Johnson and Newport, 1989; Johnson, 1992; Coppieters, 1987).

Accessibility of UG in Second Language Acquisition

A very controversial question in the literature is whether UG principles and parameters are accessible in second language acquisition. White (1989b) presents five logical possibilities in this regard: (a) UG is accessible in L2 acquisition and its function is the same as L1 acquisition; (b) UG is completely accessible, but L2 learners initially transfer the

not, it declines or vanishes at a certain age. However, Lamendella (1977) believes that since no structural or functional atrophy of neural systems takes place in the language systems of normal adults and since many adults can clearly reach high levels of second language competence, it is not legitimate to talk about a critical period in this context. A better approach is to ask whether there is a *sensitive period* for non-primary language acquisition (p.216).

Krashen, Long and Scarcella (1982) in their brief comment observed that the literature then available to them was consistent with three generalizations with regard to age, rate and eventual attainment [now referred to as ultimate attainment (White, 1989b)] in the process of second language acquisition. They presented the three generalizations as follows:

- (1) Adults proceed through early stages of syntactic and morphological development faster than children (where time and exposure are held constant);
- (2) Older children acquire faster than younger children (again, in early stages of syntactic and morphological development where time and exposure are held constant);
- (3) Acquirers who begin natural exposure to second language during childhood generally achieve higher second language proficiency than those beginning as adults (p.161).

speakers in most cases; and late learners, the 17-36-year olds failed to perform as well as the native speakers and early learners in any of the issues under investigation. It is concluded that (a) the ultimate level of attainment depends in part on the onset age (b) there are sensitive periods controlling language development during which the acquisition of different linguistic properties is fruitful and after which language learning becomes irregular and incomplete (c) the age-related loss in performance is cumulative and there is no cut off point. Thus, the age of onset has a significant effect on ultimate achievement of L2 learners.

Second Language Learning and Critical Period

After a series of research conducted by Penfield and Roberts (1959) and Lenneberg (1967), a postulation in language acquisition domain emerged as to the existence of a critical period for language acquisition, an age limit which blocks the ultimate attainment by both L1 and L2 learners. A kind of biological scheduling was assumed to be responsible for this maturational constraint on language development. Some scholars in the field commonly believe that success in L2 learning depends on the age of the learner. Johnson and Newport (1989, p. 64) used the term “exercise hypothesis” which holds that the capacity for second language acquisition, once activated, is expected to keep acting permanently for subsequent learning of additional languages. They also wrote about a second position termed “maturational state hypothesis” which holds that this capacity, like all other human capacities, is biologically scheduled to be used in specific periods of time and, whether one uses this capacity or

Maturational Constraints on SLA: Access to Universal Grammar

Hassan Irvani¹

Dr Parviz Birjandi²

Abstract

Some scholars have argued that there is a negative correlation between the onset age of L2 acquisition and performance on different measures of L2 knowledge. A kind of biological scheduling is assumed to be responsible for this maturational constraint on language development. The present study asks whether and to what extent critical period effects can be found for universal properties of language considered to be innate. Subjacency, Empty Category Principle (ECP) or That-trace effect, and Structure Dependency are the linguistic properties that are investigated in this study. The results indicated a very adverse powerful effect of the increase of onset age on the ability of the learners to detect UG violations. Moreover, age differences were also important in that early learners, the 3-9-year olds, always performed as well as the native speakers; the 10-16-year olds could not perform as well as the native

¹ Tehran University.

² Allame Tabatabaee University Spring 2002