The Necessary Conditions for First Language Learning Part 1: A. R. Luria's Investigation of Twins

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第一言語（母語）学習に必要な条件　Part 1：アレクサンドル・ロマノヴィッチ・ルリヤの双子の研究

要旨

本論文では、母語学習に必要である環境条件の基本を紹介し、とりわけ読み書きを覚える前の児童が対象の場合に効率的な第二言語指導及び学習のための含意について論じる。これらの条件は、児童発達の分野における科学的研究証拠に基づき特定されたものである。特に興味深い事例として、脳形成異常や脳疾患のない幼児の言語発達遅延が、後に何らかの介入により改善するという事例が挙げられる。ロシアの神経心理学者であるA. R. ルリヤによる一組の双子の５歳児の研究事例がそのひとつであり、その双子の幼児は、母語発達に多大な遅れがあったものの、研究者の適切な介入により早急な回復をみせた。この事例を通して、母語学習における必須条件を考察する。

キーワード：母語学習、言語教育、幼児教育
Keywords：First Language Learning, Language Teaching, Early Childhood Education

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Abstract

In this article the basic, surrounding conditions, which are necessary for first language learning to occur, will be presented. Their implication for effective second language teaching and learning, especially when working with pre-literate young children, will be discussed. These conditions have been identified based on evidence found in scientific investigations in the field of child development. Of particular interest are cases of language delay in young children who have no other brain malformation or disease that is later overcome through certain kinds of intervention. One such case, that of the Russian neuropsychologist A. R. Luria's investigation of a set of 5-year old twins whose use of their mother tongue was greatly delayed and the successful intervention by investigators that quickly remedied the situation, will be used to illustrate these essential first language learning conditions.

1. Introduction

The human ability to use language is a learned behavior. Therefore, after the required level of maturation of the central nervous system is reached, there are certain environmental conditions, specific behaviors of the surrounding people, and young children's own actions that through scientific investigation can be identified as essential for first language learning to occur. In the absence of any one of these conditions, young children's language development will be delayed. This is evidenced by the rare, yet scientifically documented cases in the delay or absence of first language learning where no other brain malformation has been identified. Furthermore, these essential conditions are especially thrown into relief in cases where intervention programs have been successful in quickly overcoming and eliminating such initial delay (Douglas & Sutton, 1978; Luria & Yudovich, 1971/1956). However, these examples have not yet been incorporated into the greater body of research in some fields where it could be instructive, including the fields of second language learning and teaching. One purpose of this article, then, is to introduce this scientific evidence to those working in such fields.

In this article these basic conditions for first language learning will be presented. Then, two cases of successful intervention to overcome language delay will be used to further illustrate and explain them. Finally, the value of identifying such conditions, and their implication for those who design second language learning programs, especially those for pre-literate young children, will be briefly discussed. In future articles in this series, other key examples that further explain these essential conditions and their relationship to rapid language learning and the activities most likely to produce it will be presented.

2. The necessary conditions for first language learning

In this series of articles, first language learning will be described. This should not be confused with language acquisition theories such as those including Noam Chomsky's proposed hypothetical mechanism, the Language Acquisition Device (LAD), as these are philosophical explanations of language development that are not scientifically testable. Such explanations are of no use in helping investigators explain how children do learn. In contrast, first language learning can be tested scientifically and thus by investigating language development in this way can provide a more detailed and accurate description of how a child comes to use language.

One often-used scientific definition of learning is, "a relatively permanent change in response potentiality which occurs as a result of reinforced practice" (Reber & Reber, 2001, p. 390). Therefore, progress in learning one's mother tongue can be inferred scientifically by recording the environmental conditions, observing children's actions and speech, and measuring any subsequent changes in future behavior under various controlled conditions. Thus, by examining a young child's learning of their mother tongue, the investigator can add or eliminate conditions to more precisely determine which one, or which combination might be most effective in producing the desired change in behavior.

Most people who interact with young children provide the necessary conditions for first language learning to a certain degree without realizing it. Nevertheless, these conditions are important to specifically identify because fulfilling them is the basic starting point, without which children's progress in learning to use their mother tongue will be deterred and the development of their higher mental processes, such as planning future action, delayed (Luria & Yudovich, 1971/1956). For this reason alone it would be useful for anyone concerned with language teaching and learning to be familiar with this information, especially if they work with pre-literate children. Two such conditions are presented:

1. The child must attend to language used skillfully by others in an immediate and meaningful context.
2. The child has to use language for themselves (speak) in increasingly complex ways.

In the first condition, *attention* is a basic requirement for learning and an area that has been the subject of much scientific investigation. One example of findings from this field is from the investigation of the orienting response, an involuntary response that functions to bring the person into a position whereby he or she is optimally exposed to the stimulus. The outwardly observable elements of the response can include eye movement or head turning toward the stimulus. Other inner changes that ready the subject to take in information more easily such as changes in brain activity and dilation of blood vessels can also be detected when an orienting response is evoked. Therefore, when an orienting response is evoked, there is a high probability that learning can take place (see Luria, 1973, 1981/1979 ; Sokolov, Spinks, Näätänen, & Lyytinen, 2002).

Skillful use of the language implies interaction with adults using language who are sensitive to how the child responds, can choose from a range of expression to explain the situation, and have the vocabulary to express a greater level of detail and exactness than, for example, another child could. An *immediate and meaningful context* denotes that the adult uses language to communicate or cause changes in the objects and the environmental situation that the adult and child both perceive with their senses at that same moment. It must be as clear as possible to the child that the words being used relate directly to these objects and actions. This also requires skill on the part of adults, as it has been demonstrated that they may understand a situation differently than a child and can interpret the child's responses to their words in ways other than the child may intend (Donaldson, 1978).

Nevertheless, at least initially, words that young children hear have no distinct meaning other than that they have been associated tem-

porally with something to which the children have received sensory impressions. For example, the child sees a lemon for the first time and perceives its color, size and shape. The child may touch it and sense its temperature, texture of skin, and weight. The child also may smell it and hear the sound of his or her mother cutting it and squeezing out its juice. Then the child may taste its juice, which might provide a new experience with its sourness. All these sensory perceptions are likely to become temporally associated with the word "lemon" from this context and become part of the child's inner concept of the object that will come to mind when he or she hears the word used in the future (Luria, 1981).

As to the second condition, when learning to *speak*, as with any fine motor skill, such as playing the violin, a person must actually coordinate their muscle movements and use them in conjunction with the instrument to become competent. Certain knowledge of how the violin is played or the ability to discriminate skillful or poor playing can be obtained by observation. But, to become skilled in playing the instrument, the violin must be physically taken up and manipulated by the person. The same principle holds true for first language learning: the child must move their mouths and vocal apparatus to learn to use language (or hands in the case of deaf children using sign language).

3. Rapidly overcoming language delay: Luria and Yudovich's twin study

Almost all children develop the ability to use their mother tongue in the first few years of their lives. However in a few cases, children do not do so, or they are observed to be significantly delayed in their ability to use language compared with their same-aged peers. This delay sometimes can be attributed to disease or brain damage. In other cases, severe social isolation is the main cause. Impairment of one or more of the organs of perception of the child (Perez-Pereira & Conti-Ramsden, 1999) can be another reason for delay. Yet there are other cases, where no such diagnoses can be made. It is this fourth case that is of particular interest to language teachers because by eliminating all other possibilities, such a delay can then be attributed to a lack of the essential conditions necessary for first language learning.

A detailed experimental example of this fourth case can be found in the investigations of the Russian neuropsychologist, A. R. Luria (1902-1977). In the short book, *Speech and the Development of Mental Processes in the Child* (Luria & Yudovich, 1971/1956), a set of 5-year old twin boys are described who, though physically healthy and without apparent brain defect, were significantly delayed in their speech and other mental abilities as compared to their peers. Except for the twins' retarded speech, their early physical development had been normal (See also Black, 2010, p. 149, 2012, p. 67-70). They were an example of what Luria called the "twin situation," where twins sometimes develop a rudimentary, closed communication system that they use with each other and one that is not comprehensible to others.

When observed at home, even though they were not isolated from others, they were usually left on their own and always played together. They attended to strangers' speech only when they heard their own names mentioned. Speech that did not refer to them appeared to pass them by. Their communication with adults using speech consisted of only a few intelligible words, and they spoke these words mostly in response to direct questions. When they were later both enrolled in the same residential preschool class and carefully observed by the

investigators, it was found again that they only interacted with one another, and they spoke to each other in their own particular, rudimentary manner.

Their speech was unintelligible to others outside the immediate context, and their own use of language was limited to emphasizing or clarifying only that which was immediately happening. For example, they often spoke each other's names as general modifiers to the immediate situation. Thus the spoken word had no permanently defined use and meaning would not be understood out of context. Luria and Yudovich (1971/1956, p. 47) write:

> But they (their names) acquired an entirely different meaning when they were pronounced in different situations and in a different tone of voice. Thus the word 'Liosia' could mean: 'I (Liosha) am playing nicely', or 'Let him (Liosha) go for a walk, or 'Look (Liosha) what I have done'.

No extended, imaginative play was observed nor did they talk about past or future events. Their play was repetitive and monotonous. For example, they would pile up cubes or lay them down in a row over and over again without constructing anything in particular. They would also transport building materials from one corner of the room to another, which was repeated without variation (Luria & Yudovich, 1971/1956, p. 41). They could not play and therefore, did not play with the other children in their preschool class, nor did they pay attention to the stories their teacher told the class. They only understood others' speech when they were spoken to directly in a concrete situation that contained many other clues that provided meaning. Despite this lack of participation in the organized classroom activities, they did not show any other signs of physical developmental differences. Luria and Yudovich (1971/1956, p. 40) write:

> They were good, cheerful, energetic, mischievous, friendly and affectionate; their movements were sufficiently alert and rhythmic and they displayed musicality. Both were efficient during meals and with their clothes, serving themselves and refusing help. When they were placed together in the kindergarten they willingly participated in duties, quickly oriented themselves in the new setting and did not present any difficulties for the teacher.

Two intervention strategies were then undertaken simultaneously. First, the twins were placed in different classes, so that it became necessary for them to interact with others. Second, one of the twins, the weaker of the two in using language and the one who took a more passive role in their play activities, received special training from the investigative team in using standard speech. In the one-to-one training, the lessons consisted first of the child being encouraged to give answers to questions, then being required to name objects, and finally being prompted to actively answer questions, to repeat complete phrases and to describe pictures (Luria & Yudovich, 1971/1956, p. 51). Transcripts and other data collected from the beginning of the training, after three months, and after 10 months are provided to illustrate the children's capacity at different stages to use language in more complex ways and for different purposes.

The results were that after only three months, both twins' speech had markedly improved, and a significant change in their ability to engage in constructive play activities

was also noted. After 10 months the language used by both boys had developed to almost the level of their peers. In addition, certain higher-level mental abilities, such as the ability to group items into categories and name the shared characteristics of the items that allowed the children to do so, were significantly more pronounced in the twin who had received the special training. Furthermore, he now was observed to take a dominant role in their play activities. They had developed the ability to narrate their play, make up stories when shown pictures, were attentive to their teacher and it was difficult to distinguish them from their classmates during group play activities (Luria & Yudovich, 1971/1956, p. 58-72).

A further example of their progress is that their use of objects in play was also more imaginative. Instead of the monotonous, repetitive activity of moving cubes from one corner of the room to another, they now were observed to make an imaginary train from a stool to carry blocks, negotiate who the driver and who the engineer were to be, add sounds and actions of the train moving, build a structure which they named as a house and consult each other verbally, with the formerly more submissive twin now directing his brother as to how the house should be improved. These are activities they did not perform just a few months before and were the kind of play activities other children their age had been doing from a much earlier time.

In the 1970s, in another scientific inquiry Douglas and Sutton (1978) replicated Luria and Yudovich's investigation in England and similar, rapid language learning was found. One difference, though, in their procedure was to make an attempt to determine with more certainty which variables were particularly effective in producing rapid language learning. Since Luria and Yudovich had found significantly greater improvement in the higher mental abilities of the twin who had received special language training, they wanted to isolate the effects of separating the twins from those of the language training. To do this, the twins were first separated for five months into two different preschool classes. Then, while still attending their own classes, both twins individually received special language training for an additional five months, as opposed to only one of the twins receiving special training in the Russian investigation.

In this case, the twins were girls. The first few years of their home life had been unstable, with their being cared for by different relatives, interspersed with care from their impoverished, single mother. As with the Russian twins, they were just over 5 years old at the beginning of the investigation and had passed normal physical developmental milestones such as the age at which they first walked, but were delayed in learning to speak. Before intervention, their level of language development was observed to be so low as to keep them from entering elementary school with their same-aged peers. Their level of language comprehension and expression was also tested to be over a full year below their chronological ages (Douglas & Sutton, 1978, p. 52). They had no other brain malfunction, though this was not definitively ruled out until they had later demonstrated rapid language development.

At the start of the investigation, the twins first spent one term of the preschool year together in the same class to help them adjust to their new school. Then, for the intervention phase during the 1974-1975 school year, they were separated and attended different forms of the same two-form entry infant school for another term. After that, while still attending

their separate classes, both children individually received 30 minutes of language instruction once a week from a psychologist for five months. They also attended separately, on alternate mornings, a remedial group session that was part of the regular programming of the school during the five months of language training.

The goals of the language training sessions were to 1) teach the functional usage of speech, 2) increase sentence complexity and length of semantic expansion, and 3) teach the usage of different parts of speech and increase vocabulary (Douglas & Sutton, 1978, p. 51). The sessions were also designed to help the twins overcome what has been called the "twin situation" mentioned also by Luria and Yudovich (1971/1956). Therefore, another goal of the sessions was to, "stimulate language as a functional method of communicating, enabling ideas and information to be exchanged between the adult and child" and to introduce the twins "to alternate and new ways of structuring their experiences" (Douglas & Sutton, 1978, p. 54). A variety of materials was used to do this, often as visual stimuli for discussion. In addition, the psychologist met once a week with the classroom teachers, who had been fully briefed on the program, to make suggestions on how to stimulate speech in the classroom and report progress and difficulties.

The twins were evaluated using several standardized psychometric and linguistic assessments three times: before separation, after the five-month separation period, and after the subsequent five-month combined separation and language-training period. Though the investigators questioned the validity and reliability of several of these tests, the twins demonstrated gains on all of them. However, the gains after the separation-only phase of intervention, before the special training had started, were slight and could be attributed to testing effects. In contrast, the increase in scores after the five-month concurrent separation and language-training phase, especially on the Wechsler Pre-School and Primary Scale of Intelligence (WPPSI) for both the verbal and performance scales was significant. At the end of the investigation the twins both tested at the level of other children their age and this result correlated with their teachers' observations and evaluation of their abilities. In sum, after 10 months of intervention, the twins were now at a level of functioning that would enable them to move on in their education with their peers. The results also suggest that it was the special language training that was the key to the children's rapid improvement in the final five months of the investigation. In addition, there was evidence that both twins had maintained their level of progress after the special intervention had ended.

4. Discussion

Luria and Yudovich's (1971/1956) investigation of the language development of a set of twins and Douglas and Sutton's (1978) replication of this study have obvious implications for parents, childcare workers and those in the field of child development (Black, 2010, 2012). In addition, these investigations also provide valuable information for language teachers. This is because both give a rare, more detailed view of the conditions required for first language learning to occur. Furthermore, these conditions are inferred from data that is observable and measureable, has been collected under controlled conditions, and investigated through experimental procedures that can be replicated. Let us review the conditions:

1. The child must attend to language used skillfully by others in an immediate and meaningful context.
2. The child has to use language for themselves (speak) in increasingly complex ways.

Regarding the first condition, in both investigations, though the children had no disease or brain malformation and were surrounded by speakers of their mother tongue, they were still significantly delayed in their language development. A likely reason for this was that it was not necessary for them to attend to the language spoken around them, as their own company and rudimentary speech systems were sufficiently engaging. It is clear that initially, the children in these investigations did not learn to use language by merely being exposed to it. One part of the intervention, their separation into different classes necessitated their increased use of speech and need to pay attention to others' speech. Yet even after five months of separation and before the extra language training sessions began, evidence from the English investigation suggests that separation alone was not sufficient to foster rapid language development, either.

Though children do learn to use language to some degree from the other children and the people around them, a skilled adult has the potential to interact more purposefully and sensitively with them. From the results of these investigations, attending to and interacting with such an adult who has a range of ways of discussing a situation and whose speech can provide more precise models of effective language use would appear to be necessary for rapid language learning. Another possible variable creating the rapid language development seen after only five months of training in the English investigation was that the preschool teachers and the children's parents were fully informed of the goals of the special language training and to some degree had interacted with the children in a similar way. This would have strengthened the work done in the weekly 30-minute sessions with the psychologist. How a supportive surrounding community can help maximize classroom instruction in language learning is an area that needs to be explored further.

As to the second condition, these investigations highlight the fact that early on it is the children's own action of speaking about what is happening in the immediate situation that greatly quickens their progress when learning to use their mother tongue. The special training in both investigations centered on eliciting speech from the children and Luria has demonstrated elsewhere how children's own speech focuses their attention and helps create stronger associations between the spoken word and elements in the environment compared with merely listening to the speech of others (Luria, 1961, 1973, 1981/1979; Vygotsky & Luria, 1993/1930).

Luria provides an example of how self-speech focuses children's attention when citing evidence from his colleague, E. D. Homskaya (Luria, 1973). In her investigation, children who had just started elementary school were asked to make a certain movement when they saw a lighter shade of a color and a different response when they saw a darker shade of the same color. As the speed of presentation increased, more mistakes were made, even up to 50% of the time. However, if the child was instructed to say either the word "pale" or "dark" at the same time as emitting the appropriate response, their ability to accurately discriminate the shades increased and mistakes in

responding decreased. Luria summarizes, "The inclusion of the child's own speech enabled the differential features to be distinguished, made sensitivity more selective, and made the responses much more stable" (Luria, 1973, p. 264).

Besides the outwardly observable functions of communication and socialization, this evidence suggests that language use itself has perhaps an even more important role, that of a catalyst in developing human beings' inner thinking structures. For as children learn to use their mother tongue they are simultaneously developing a new ability—a mental framework for organizing their thoughts and a means of making the development of other higher mental abilities possible (Luria, 1981/1979; Vocate, 1987). They are learning not merely what something is called but creating their own inner concept of what that thing *is*, by associating perceptions they have received from their sensory organs with the coordinated muscular movements of their own speech. These scientific investigations also illustrate how initially, without children's own production of language in a meaningful context, the ability to develop higher mental abilities will be delayed, and other behavior based on these abilities, such as planning future action and carrying it out, will remain immature.

5. Implications for teaching a second language to pre-literate children

In order for teachers to create effective second language learning programs it is useful to understand the conditions under which children learn to use their mother tongue most rapidly. Thus, by creating language-learning activities that incorporate human beings' natural capabilities to the fullest, rapid second language learning can be achieved. The investigations above provide evidence that fulfilling these two conditions is likely to produce rapid second language learning especially in younger children, and are conditions under which they cannot help but learn.

As attention is a main component of the first condition, the teacher must become skilled in understanding what young children are attending to at any particular moment, and when they are paying attention to the learning activities the teacher has arranged and when they are not. If they are not attending, a change in the activities and possibly the learning objectives will need to be made. Another implication these conditions has for second language teachers whose students are young children is that the words and phrases taught need to, at least initially, be done so in a concrete situation that conveys meaning. Therefore, these words and phrases should be ones that relate to the objects, actions, and concepts that the children are already familiar with in their everyday lives and experiences. For example, it would be ineffective to ask a child who lives in a thatched hut and who has never seen a piece of furniture to learn the word "drawer" instead of other words describing their immediate environment and ones they can use to make changes in it.

Furthermore, young children have not fully developed their higher mental abilities. Therefore, the activity of discussing with a 4-year old child what his or her plans are for the weekend is also likely to be ineffective because the child may not have yet developed the mental skills for such planning even in his or her first language. Instead, based on the results of these investigations it would be more productive to choose to teach equivalent words and phrases for ones children are already observed to use in their first language. Then, teachers should have children use these expressions as a foundation

to start moving from describing the immediate situation to more abstract expression such as making future plans and recalling past events in the target language.

Another implication is that the younger children are, the closer the method of instruction has to be to the way children learn to use their first language in order to be effective. This means that interaction with a skilled user of the target language is crucial. Young children learn their mother tongue by listening to and then speaking it, not reading and writing it, of course. Emphasis in second language learning programs should be put on speech production. Speech can be elicited in various ways. For example, the basic scientific behaviorist principles of operant conditioning can be drawn upon to elicit speech behavior in meaningful situations.

In operant conditioning, the concern is with how different consequences that immediately *follow* an action may change the likelihood of that particular action being emitted in future situations. One of the consequences of emitting a particular response can be reinforcement. Reinforcement in its specific, scientific meaning is any event that causes the immediately preceding response (a specific instance of behavior) to be emitted more frequently in similar situations in the future (Holland & Skinner, 1961). Therefore, if a child says the word "candy," immediately receives a piece of candy, and is observed to utter the word "candy" afterwards more frequently than before, the child's receiving candy in that situation would be called reinforcement (see also Black, 2009). Although it is not within the scope of this article to explain in detail such learning principles further, scientific evidence gained from rigorous experimental procedures repeatedly has revealed that under certain conditions reinforcement can have a powerful effect on learning, and has been influential, especially in teaching young autistic children to use language (Lovaas, 1977, 1987, 2003).

Finally, there is the question of how the one-to-one activities described in the investigations that have been demonstrated to foster rapid learning in young children can be modified for larger groups of young students that teachers are often faced with in preschools or kindergartens. Another question is how a supportive language environment can be built by other teachers in a preschool or kindergarten who may not be so skilled in the target language, but yet have the potential to make a significant contribution to the success of the students who are learning a second language. These questions will be dealt with more fully in future articles in this series.

6. Conclusion

Every effort should be made to use teaching methods that allow children to learn easily and rapidly. Based on the evidence presented in this article (Douglas & Sutton, 1978; Luria & Yudovich, 1971/1956), the necessary conditions for first language learning presented here have indeed correlated with rapid learning. Therefore, when planning second language teaching programs, especially for pre-literate children, there is a high probability of producing rapid language development when these conditions are arranged. Furthermore, special language intervention need not create much extra work for teachers. Instead, materials and activities that are currently in use for language development in the child's mother tongue can be adapted for use in the target language.

Despite this, the necessary conditions presented for first language learning proposed here are rather general and the actual tech-

niques used in the investigations cited have not been explained in detail. Therefore, in the second article in this series, another example of rapid language development—that of the deafblind Helen Keller, and the activities her teacher Anne Sullivan used with her will be explained. These can provide more insight as to the exact details of the activities and the kinds of interaction that are most likely to produce effective language learning. Finally, the third article in this series will explain the relationship between the necessary conditions presented here and rapid language learning in second language programs for elementary school children.

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Acknowledgement

I am indebted to Keith Wigglesworth for carefully reading previous drafts of this article and suggesting major revisions. Furthermore, his patient explanations and the help he gave as I attempted to draw out the key points from these scientific investigations and apply them to my work as a language teacher have been invaluable.