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The Impact of Maternal Language in Shaping Children's Language Acquisition

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Abstract

Language is one of the first bridges between the child and the social world. This thesis explores how that bridge is formed, focusing on the role of maternal language in a child's early language development – and the neural systems supporting it – drawing on research from neurolinguistics and developmental psychology. Evidence on prenatal language exposure and maternal input is integrated to highlight how caregivers adapt their language to support language learning. Special attention is given to bilingual development, illustrating how early exposure to multiple languages interacts with cognitive flexibility in childhood. Theoretical perspectives are used to provide a solid framework for understanding language acquisition from multiple standpoints. Overall, the thesis proposes that maternal language is a central meeting point between brain development, affective engagement, and social exchange, resulting in shaping both the linguistic growth and the child's integration into the social world.

Il linguaggio è uno dei primi strumenti che collegano il bambino e il mondo, particolarmente quello sociale, intorno a sè. Questa tesi esplora come si formi questo ponte, concentrandosi sul ruolo del linguaggio materno nello sviluppo linguistico precoce del bambino – e sui sistemi neurali che lo supportano – attingendo dalla ricerca in neurolinguistica e in psicologia dello sviluppo. I dati sull'esposizione prenatale al linguaggio e sull'input materno verranno integrati per mostrare come i caregiver adattano il loro linguaggio al fine di sostenere l'apprendimento linguistico. Un'attenzione particolare è dedicata allo sviluppo bilingue, illustrando come l'esposizione precoce a più

lingue interagisca con la plasticità cognitiva durante l'infanzia. Le prospettive teoriche sono utilizzate per fornire un solido quadro di riferimento per comprendere l'acquisizione del linguaggio da molteplici punti di vista. Nel complesso, la tesi propone che il linguaggio materno rappresenti un punto di incontro centrale tra lo sviluppo cerebrale, il coinvolgimento affettivo e lo scambio sociale, contribuendo così a plasmare sia la crescita linguistica sia l'integrazione del bambino nel mondo.

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Introduction

The mother's voice is often the earliest and the most consistent linguistic signal that a child experiences, present even before birth and continuously significant for a child after delivery. A familiar moment in early childhood, when the mother speaks to her child in a voice that seems softer and slower than usual, leads to interactions that carry incredible developmental significance. In these exchanges, children hear language, discover how communication works, how sounds connect to intentions and goals, and how attention can be shared between two minds. What appears to be instinctive caregiving behaviour, is a much more complex system, through which a bond between the mother and the child forms and linguistic abilities begin to take their shape. The present thesis, *The Impact of Maternal Language in Shaping Children's Language Acquisition*, will attempt to explain language acquisition principles and explore this special bond that forms between the mother and her child through affection and security.

Language acquisition is often looked upon as one of the most impressive goals that humans have achieved through development. Within only a few years, children progress from producing undifferentiated sounds, to linking together words and concepts, eventually arriving at a point in which they are able to construct sentences that can describe their environments, share their needs, and explain their thoughts. Some explanations of this process emphasize the biological capacity for this acquisition, while others shift focus on environmental learning, but nonetheless the impact of environmental input could not be disregarded as irrelevant.

At the theoretical level, debates between different historical perspectives have all contributed to the broad understanding and large amount of evidence that emerges in the

field of language acquisition and children's developing cognitive capacities. Although many great minds proposed their own ideas, growing evidence suggests that their positions, although sometimes quite contrasting, do not have to be understood as mutually exclusive.

Among various influences on early communication, maternal language plays a very important role. From the prenatal period, the child gets accustomed to its mother's voice, and after birth, these familiar patterns of pitch and rhythm play a significant role in child's life. The modifications of maternal language do not seem random, instead, they suggest an alignment with infant's cognitive capacities. Importantly, maternal language also conveys emotional information to the child, reinforcing engagement and providing guidance, linking the child's language-learning with broader socio-emotional development.

Different variations in input and contexts, such as bilingual contexts in which the child is exposed to more than one linguistic system while experiencing maturation, bring light to even more particular patterns of maternal speech. Rather than slowing the acquisition due to the complexity of input, bilingual exposure often shows the adaptability of early learning mechanisms. Infants show sensitivity to language cues and demonstrate how they are capable of organizing multiple kinds of input.

Simultaneously, variability in vocabulary outcomes across children highlights the importance of all interacting factors, including responsiveness, guidance, quantity and quality of input and socioeconomic context. Understanding of language development, therefore, should be reached by considering all the factors within a network of biological, cognitive, and environmental influences.

The power of attachment and forming meaningful relationships shape the child's sense of security and its willingness to interact and explore. A responsive caregiver does so much more than provide the child with linguistic material, she creates a context in which the child can develop and where communication is meaningful and rewarding. The maternal voice becomes a source of linguistic structure, as well as the child's signal of safety and familiarity. Understanding language acquisition and complex communicative environments, therefore, requires us to consider not only cognitive structures and their maturation, but also the relational system in which the child receives care and ultimately, love.

The chapters that will follow explore the nature of language and its neural correlates, the definition and significance of maternal input, bilingual contexts and other interacting factors, as well as theoretical frameworks that link language acquisition, cognitive maturation, and attachment processes. By integrating findings from various fields, the work in front of you will aim to explain in greater detail how maternal language contributes to the child's linguistic development.

Chapter 1: Defining “Language” and the Brain Areas

Involved in Its Production

1.1 The Nature of Language

Language is one of the most remarkable abilities that humans have. With a limited set of sounds, we can produce and express an unlimited number of ideas, intentions, and emotions. This allows us to share our experiences with the world, build relationships with others, and pass knowledge across generations. Behind every spoken word lies a sophisticated system that connects our brain, body, and the social world. Understanding what language is and how it operates, therefore, requires exploration of how meaning, structure, production, and communication come together in the human mind.

The following section introduces the fundamental building blocks of language: phonology, morphology, syntax, and semantics. These components form the foundation upon which later discussion of language development, brain organization, and mother’s input will be built. By understanding how exactly language is structured, we can better explore how it is learned by children, how it is represented in the brain, and how it is shaped by interaction between children and those who speak to them. Phonetics is defined as “the science of pronunciation, the science which investigates the mode of formation of speech sounds and their distribution in connected speech.”¹

When studying speech, it is clear that some system of sound representation is essential. Although speech sounds could possibly be analyzed without actual written symbols,

¹ Daniel Jones, *An Outline of English Phonetics*, G. E. Stechert & Co., New York 1922, p. 1.

doing so would make it impossible to describe how sounds are organized and how they occur in speech. For this reason, phonetic symbols play a crucial role in linguistic analysis, as they allow learners to identify and compare speech sounds in a precise way.²

The phonology of a language refers to the way a language organizes and uses speech sounds, not only which sounds are important but also how they are combined, pronounced, and patterned in real speech. Although people speak their native language fluently, they are often unaware of the detailed rules that lay in the bases of these sound patterns. A very useful way to think about phonology is to see it as a system that groups many slightly different types of pronunciation into meaningful sound categories, for example different sounds can be pronounced in several ways depending on where they appear in a word, as well what sounds precede them. A trained phonetician can hear very distinct variations of sounds, depending on if they are produced as a strong burst of air at the beginning of the word, lack of the burst after certain consonants or even the release of the air through the nose.³

Despite this, ordinary speakers treat them as variations of a single sound category, or phoneme, which children must learn how to recognize and use appropriately in different words and sentences they make. A phoneme can be understood as a set of speech sounds, that the speakers of a language perceive as the same, even though the sounds are produced in a slightly different way. As children get older and acquire their language, they also become sensitive to the patterns that govern how sounds can be arranged, such as which

² Ibidem.

³ Jean Berko Gleason, Nan Bernstein Ratner, *The Development of Language*, Pearson, Boston 2017.

combinations of consonants and vowels are possible and how stress on a certain word can change the meaning of a phrase. Some phonological patterns are mastered early in the first years of life, while others, including intonation or subtle differences in stress continue to develop well into the school years.⁴

Joined together, these processes show us that phonetics is not just about sound production, but also about learning a complex system that links sound patterns to meaning in a structured way. While phonology explains how speech sounds are organized and perceived, it doesn't tell us yet how those sounds become units of language that hold meaning.⁵

When a newly formed verb enters the language, speakers don't need guidance to form its past tense or plural forms, they rely on the knowledge of how the language organizes meaning in smaller components. These units of meaning are known as morphemes, and words can contain one or several of them. Some morphemes, called free morphemes, can stand on their own as complete words, while others must attach to a host word in order to function. English language, for example, uses bound forms of morphemes such as -ness or -ing to change the grammatical meaning of a word, allowing speakers to derive new forms like nouns from adjectives or express ongoing action. In contrast, other bound morphemes do not create new words, but modify existing ones to express information such as tense, number, case, gender and person. In Latin, grammatical cases such as subject and object are encoded by word endings, whereas English mainly depends on word order to convey who is doing the action and what action is being done. Word

⁴ Ibidem.

⁵ Ibidem.

endings act as inflectional markers and can signal information such as tense, number, possession, or grammatical cases. In the case mentioned, in Latin, endings signal grammatical cases like subjects and objects, allowing the speaker to identify roles independently from word order. English, however, lacks many of such case endings on nouns, primarily relying on word order to demonstrate who is doing the action and what object is enduring the action. Some languages like Latin, Russian and Hungarian show high inflection and have many different singular and plural forms of verbs. English verbs also show inflectional markings, although a very limited one such as including -s for third person singular, possessive endings, plural markers and endings that signal is the verb is in past tense for example. Even within this simplified system, speakers still follow quite complex rules that allow them to generate correct forms of words they haven't even heard before.⁶

A central question for language development, therefore, is how children master these mentioned morphological patterns and how closely their emerging knowledge resembles the grammatical knowledge of adults. This leads us naturally into syntax, which concerns the principles that govern how words are combined into sentences and how said sentences can be rearranged and transformed while preserving meaning. A single thought can be reshaped into questions, negatives or passive forms, yet still remain recognizable. This flexibility explains why speakers of a certain language can produce and understand an almost unlimited number of sentences, including completely new ones they haven't heard before. Even when unfamiliar words are used, people can often judge whether a sentence is well-formed because its structure follows the expected grammatical rules of the

⁶ Ibidem.

language. In this way, syntax and morphology work together to carry information, which further allows speakers to interpret relationships in a sentence.⁷

However, in early childhood the path toward full syntactic mastery happens gradually. Young children's first utterances may seem simple, but they already reflect an understanding of relationships, such as the difference between an agent and an object. A child saying a simple sentence that includes a subject, a verb, and an object is maybe not grammatically correct, but is still communicating a structured idea. Over time, children refine this system and incorporate grammar rules, including word orders and function words, to successfully form longer and longer sentences, negatives and questions. This development shows that syntax is not learned all at once, but emerges with time and gradually allows children to express more complex meanings, with greater level of precision, as they get older.⁸

Linguistic competence refers to the knowledge of the structural aspects that a language carries, including its sound system (phonology), morphology, syntax, and semantics. A person who has acquired all of these components is able to produce utterances that are grammatically correct. Nevertheless, knowing how to combine words together is only a part of linguistic competence. Understanding what those combinations actually mean requires the development of a semantic system.⁹

Semantic development concerns how children build their internal world of meanings, often described as the mental lexicon. Learning what words hold which meanings is not

⁷ Ibidem.

⁸ Ibidem.

⁹ Ibidem.

simply a matter of pairing sounds with objects, because words exist within intricate systems of relationships. Even very young children may use familiar words they heard adults around them use, yet their meanings do not always match adult definitions, which shows that children's early vocabularies are not yet fully organized into complex networks that characterize adult semantic knowledge. As development continues, children slowly form more structured connections between words, organizing them into hierarchies, and lastly, into meaningful groups.¹⁰

For adults, concepts are linked to more broad or more narrow categories, but the links between the categories emerge slowly and in childhood. Studying how this network grows involves tracing how children move from simple word use to richer systems of meaning. Over time, children expand their vocabularies, become aware of words and thoughts and become able to reflect on or comment on the language they use. In this way, semantic development extends beyond sole learning of labels and becomes the foundation for deeper linguistic and conceptual understanding. As children's understanding of meaning further deepens, language becomes more than just a collection of words. It becomes a system for representing thoughts, which raises a fundamental question about what language actually is.¹¹

Language is often equated with speech. Almost automatically spoken language is in our everyday lives. We speak constantly, often without even noticing it, and speaking in our mother tongue feels very effortless and natural.

¹⁰ Ibidem.

¹¹ Ibidem.

Because speech is the most familiar form of language, it is often assumed that language necessarily depends on its vocal production. However, the existence of sign languages challenges this premise. Sign language can be understood as a complete communicative system that uses bodily actions that are visible to others, for examples the movements of the hands and face, in order to convey meaning. It does not function as a simplified option instead of spoken language, but functions as a structured linguistic system that has its own organization and rules. Other than gestures and pantomime, sign languages possess structures comparable to those found in spoken languages, including units that once combined, form meaningful expressions.¹²

Historically, systems of visual ways of communicating appeared whenever individuals deprived of hearing could interact with other people and develop communicational patterns based on gestures. Over time, these systems became conventionalized, forming communities in which signs held functions in the same way words do in spoken languages.¹³

The developmental context of a deaf child is characterized by reduced access to auditory communication and stimuli in the early life stages. During the first years of life, hearing infants move from hearing sounds to responding to them, producing vocalizations that develop into words and eventually, into structures of speech. Deaf children, however, don't have access to these same experiences, which may influence their social orientation, since they encounter more limited opportunities to form relationships with family and peers due to the absence of verbal interactions. In communities of deaf individuals, sign

¹² William C. Stokoe, *Sign Language Structure: An Outline of the Visual Communication Systems of the American Deaf*, in "Journal of Deaf Studies and Deaf Education", 10 (2005), pp. 3–37.

¹³ Ibidem.

language serves for practical communicative purposes, as well as for social and cultural purposes, through which they enable these individuals to participate in everyday interactions and support group identity.¹⁴

Separating language from speech could allow us to rethink what language is. Spoken words are only one possible manifestation from this perspective, speech appears as a later and highly efficient solution, rather than a starting point of language itself. Language works by linking mental representations to signs that stand for them. Words, gestures, and visual symbols function because speakers and listeners agree on their meaning, not because the form of the sound naturally reflects its content. In other words, words do not just resemble what they refer to; their meanings are learned and shared within a community. This might be what gives language its flexibility and power and could help us better understand the cultural differences in which different nations share and describe their feelings, thoughts, and ideas.¹⁵

Human language allows us to refer to things that are abstract, or at times even imaginary; it is possible to communicate thoughts and memories from any time period and even make plans that haven't even happened yet. Through symbols, thoughts can be externalized, transmitted to others, used for social interactions and storytelling, and even serve us as a tool for reasoning about other people's minds. Language does not replace a thought but rather expands it. According to Corballis, the acquisition of language begins with an

¹⁴ Ibidem.

¹⁵ Michael C. Corballis, *From Hand to Mouth: The Origins of Language*, Princeton University Press, Princeton–Oxford 2002.

initial grasp of communicative forms in children, who then gradually strengthen their understanding through imitation and associative learning.¹⁶

The debate that surrounded the origins of language has had many disagreements about the mechanisms through which language is acquired. Before the rise of nativist theories that will be discussed later, behaviourist perspectives dominated the field. Burrhus Frederic Skinner represented behaviourist views and proposed that language develops through processes of operant conditioning and reinforcement. In his view, children receive responses from their environment, and those responses reinforce certain vocalizations over time, therefore in his framework language is understood as behaviour that is maintained through social mediation, and grammar regularities show the cumulative effect of reinforcements the child had. He claimed that grammar patterns, in fact, emerge because certain forms are more effective than others within a verbal community. Language is represented as a type of behaviour, more specifically verbal behaviour, and not a mental system. Therefore, his theory is constructed of antecedent conditions, the verbal responses to those conditions, and the consequences (or reinforcement) received.¹⁷

Reinforcement in his opinion does not always have to be explicit teaching, it can also be provided through attention and physical contact, and responses can then become associated with basic needs. A primary reinforcer could be a stimulus that has a biological

¹⁶ Ibidem.

¹⁷ Burrhus F. Skinner, *Verbal Behavior*, Appleton-Century-Crofts, New York 1957.

survival value, like food, and a secondary one requires conditioning and association with primary reinforcers.¹⁸

Additionally, he introduced the concept of “verbal operant”, that provides classification based on a function that verbal behaviour serves in an interaction, so he shifted the focus from how an utterance sounds to why it is produced and how it is reinforced in a communicative situation. A mand is an operant that is used to request something and obtain it, usually driven by a need or deprivation, and therefore it is reinforced by reaching the requested or desired outcome. A tact is a verbal operant that serves a descriptive purpose, allowing the speaker to share their experience with another person, therefore its reinforcement is fulfilled through social acknowledgement. An echoic is an operant that functions through processes of repetition and imitation, and it is reinforced by the correspondence between the sound heard and the sound produced. An interverbal operant is also triggered by another verbal stimuli, but it does not directly resemble it, serving its purpose for conversations and questions, and resulting in social reinforcement. The final verbal operant is the autoclictic, used to refer to those elements that modify and organize other verbal responses with the goal of the listener interpreting the message correctly, leading to reinforcement through the effect they achieve on communication.¹⁹

However, the attempt to account for the complexity present in human language only through principles based on reinforcement and conditioning raises many questions. How do we produce sentences that we have never heard before? How do children acquire

¹⁸ Ibidem.

¹⁹ Ibidem.

grammar rules even without consistent correction and feedback? Can reinforcement mechanisms fully explain and account for abstract syntactic relations?

The theoretical position of Noam Chomsky offers a direct contrast. In his critique of behaviorist approaches, particularly Skinner's approach, he argues that explanations based on associations and reinforcement between the stimuli and the response fail to consider the complexity of human language. The laboratory concepts used in such models as "reinforcement" are, in his opinion, applied too broadly and loose precision making it possible to consider every linguistic behavior as a conditioned one, without clarifying the important underlying mechanisms.²⁰

Chomsky gave examples of children producing utterances they have never heard or encountered before, despite the fact they receive limited and quite imperfect input, suggesting that their linguistic knowledge cannot be derived solely from their environmental experiences. He also pointed out how explanations from behaviourists often fail to describe and explain the utterances that are not linked to a stimulus that's observable, such as the thoughts we generate and the objects we reference that are not present at a given moment.²¹

Reinforcement, as behaviourists report it, is assumed after a response occurs rather than independently, so its value as a causal mechanism Chomsky sees as limited, questioning the strength of reinforcement as an explanatory principle. In their views, a response will be considered as reinforced if it increases in frequency and therefore appears more often,

²⁰ Ibidem.

²¹ Noam Chomsky, A Review of B. F. Skinner's Verbal Behavior, in "Language", 35 (1959), pp. 26–58.

but in language development it is very difficult to determine when this reinforcement occurred or what was it that specifically produced the learning effect.²²

Instead, Chomsky proposed that language acquisition must involve internal capacities that guide interpretation of input and therefore enable the rapid development of grammar. The underlying structural organizations, including relationships between sentence elements, cannot be seen as a chain of conditioned responses, but need the involvement of our internal processes that will guide language development beyond what our experiences from environment can provide. From his perspective, communicative interaction could provide exposure that is necessary but cannot explain how children attain the abstract and generative properties of a language on its own.²³

Tracing back to grammar, that is an important topic that will be mentioned again in the following chapters, a central mechanism that supports generativity is recursion. Grammar recursion allows the embedding of phrases within phrases, which is something that distinguishes human language from simpler forms of communication observed in other species. Recursion supports cognitive growth and enables it by allowing children to understand and manipulate complex structures. As babies learn to form sentences, they simultaneously develop critical thinking skills and cognitive flexibility, which is essential for problem-solving and reasoning.²⁴

The ability to use grammar recursion is indicative of the language proficiency the child has, as children who demonstrate recursive patterns in their speech reflect the

²² Ibidem.

²³ Ibidem.

²⁴ Corballis, *From Hand to Mouth*, op.cit.

understanding of grammar rules and show they can use their communicative abilities beyond just simple statements and descriptions. In a way, we can say that this ability fosters creativity and allows children to express unique thoughts, new ideas, and even enables playful experimentation within a language. The recursive capacity of language also qualifies them to engage in discussions that require them to have an understanding of relationships between concepts. For instance, they can learn to describe actions involving multiple subjects, which is crucial for storytelling and understanding of social dynamics.²⁵

Bearing in mind all of this, the following question might naturally arise: how is it possible that children acquire language with such remarkable ease, given the contrast to the complexity of the system they master? In a handful of years, children move from minimal communicative abilities to producing grammatically structured and meaningful utterances. Examining how this transformation occurs is essential for understanding the nature of language itself.

²⁵ Ibidem.

1.2. The Emergence of Linguistic Competence

Children's language acquisition is a complex process, therefore, it should not be reduced to simple imitation or conditioning. A striking observation is the fact that children across various cultures and linguistic environments are capable of learning any human language, which can point to the existence of some universal properties that all languages hold. Learning a language, however, may not be a fully predetermined process.

A child's vocabulary expands at a remarkable length and can reach an estimated amount of 10,000 to 15,000 words between the time period of 18 months and 5 years. Each child learns a different number of words and progresses at its own pace. This rapid growth highlights the important role of brain plasticity during early childhood, which allows children to absorb linguistic information and organize it with ease. Imitation plays a role in this period, but cannot account for the complexity of grammar and vocabulary children acquire alone.²⁶

Elissa Newport argues that children initially process language in a simplified manner, which later gradually allows them to build more complex structures over time. This view is known as the "less is more" principle, and it explains how children's restricted memory at a young age and their processing abilities that are still underdeveloped, lead them to attend to simplified aspects of input which may make underlying patterns more accessible. In this view, what once appeared to be a limitation may now function as an advantage, guiding children toward regularities that support learning. In the early stages of language use, a child may use partial or inaccurate constructions, yet these forms reflect

²⁶ Ibidem.

the active engagement with linguistic structure rather than random errors. Because young learners are less able to encode complex constructions and stimuli in full detail, they may store only partial components. This selective encoding lowers the number of possible relationships between form and meaning that need to be considered, making it easier to identify structural units such as morphemes.²⁷

As their cognitive capacities expand, these early representations are progressively reorganized, which therefore allows more complex grammatical relations to emerge. These stages are shaped by maturation. An important thing to note is that the “less is more” principle is presented as an alternative to claims that attribute successful language learning primarily to innate grammatical knowledge.²⁸

The proposal that humans possess innate grammatical knowledge is associated with Noam Chomsky and his view is that language should be understood as a system of internal knowledge. He highlights the distinction of competence, defined as “the speaker-hearer’s knowledge of their own language” and performance, defined as “the actual use of language in concrete situations.” In his words, “If the grammar is, furthermore, perfectly explicit — in other words, if it does not rely on the intelligence of the understanding reader but rather provides an explicit analysis of his contribution — we may (somewhat redundantly) call it a generative grammar.”²⁹

He proposed that grammar should be understood as a model of competence on a speaker-hearer level, capturing rules that allow sentences and expressions to be formed and

²⁷ Elissa L. Newport, Maturation Constraints on Language Learning, in “Cognitive Science”, 14 (1990), pp. 11–28.

²⁸ Ibidem.

²⁹ Noam Chomsky, *Aspects of the Theory of Syntax*, The MIT Press, Cambridge (Massachusetts) 1965, p. 4.

interpreted later. A very important aspect of his definition is that grammar must be explicit and specify systematically how descriptions become assigned to sentences and not rely on reader intuition. The goal of linguistic theory, according to this perspective, is to identify the mental structures that support language and uncover the organization of this internal system.³⁰

A property of human language deemed essential by Chomsky is its creative character, meaning that we can produce and understand an infinite number of sentences, even new ones that we never even encountered before. To explain this human capacity, grammar should be viewed as a system of rules that can generate this unlimited number of sentences from limited elements. Traditional approaches are, in his view, seen as inadequate, since they focus on describing observable linguistic patterns and not on explaining the mechanisms that make the production possible. In this way, generative grammar aims to identify the internal system of needed rules that account for linguistic creativity.³¹

Chomsky's view of how children learn a language includes his concept of innate grammar. Proposing that a child constructs an internal base of grammar even though they receive very limited input, called primary data, he concludes that this input would be insufficient and that the child must already possess certain limitations that guide the learning process. In this way, language learning requires an innate linguistic theory, the biologically given predisposition that defines the possible forms that the human language

³⁰ *Ivi.*

³¹ *Ibidem.*

could take and provide a strategy for the human to select an appropriate grammar from the evidence available. This concept later becomes known as “Universal Grammar.”³²

Opposing views of the time were already mentioned behaviorist approaches that argued languages is learned through imitation and reinforcement, but different ideas also came from structuralists before Chomsky formulated his theory. The structuralist proposal could be represented by Leonard Bloomfield, who approached language as an observable system that could be studied in a scientific way, but through the analysis of linguistic forms and patterns observed and identified directly in speech, different than the argument that they should be examined through mental representations or internal knowledge. From a structuralist view, linguistic analysis should focus on the identification of regularities in sounds and grammatical constructions, and this orientation shows a broader attempt to establish linguistics as a primarily empirical discipline grounded in observation.³³

Structural views were limited in their explanations regarding the non-observable mechanisms underlying language acquisition, with Chomsky's powerful statements about internal grammar knowledge, leading to the debate that places focus on innate biological capacity that constraints the form linguistic systems could take over the social processes through which communicative abilities could develop. Hence, later approaches sought to observe how exactly the unique human forms of cognition could emerge in cooperation with environments. Michael Tomasello claimed that the nature and characteristics of human communication arise not primarily from specialized grammatical structures, but from capacities for cultural learning. The emergence of language in his framework is

³² Ibidem.

³³ Leonard Bloomfield, *Language*, George Allen & Unwin, London 1935.

connected to humans' capacity to understand that others are intentional agents like themselves. This ability would lead children into engaging in cooperative interactions and allow them to participate in shared activities in which they can internalize those communicative patterns that are present in their environment.³⁴

His discussion begins from what he refers to as a puzzle, the fact that human cognitive abilities became unique and distinctive, in quite a short evolutionary time even though we are genetically similar to great apes. Humans demonstrate very complex symbolic communication and technological innovation, humans even invented a large amount of social institutions, differences that cannot be explained solely through evolutionist approaches, but instead they reflect uniquely human forms of cultural transmission.³⁵

Cultural transmission carries a very important role in his opinions, since communicative practices are not invented by each individual for themselves, but are inherited and refined across different generations. The concept of cumulative cultural evolution puts forward the idea that a defining feature of human cognition lies in its capacity for cultural innovations to be preserved through generations and elaborated with time. Human cultural transmission allows behaviours that are still newly-acquired to remain stable while at the same time undergoing improvements and producing higher complexity over time, a process he refers to as a "ratchet effect".³⁶

His discussion of early infant cognition draws on developmental traditions that see nature of learning as a constructive process, including perspectives associated with Piaget,

³⁴ Michael Tomasello, *The Cultural Origins of Human Cognition*, Harvard University Press, Cambridge (MA) 1999.

³⁵ Ibidem.

³⁶ Ibidem.

whose views will be better explained in Chapter 3. Tomasello does describe that knowledge emerges through sensorimotor engagement and experiences, but doesn't rely on defining human cognition solely on these processes, proposing that the much needed and crucial transformation in development occurs when children begin to engage with others as intentional agents and participate in interaction that is culturally organized. This transition then presents the infant with new learning mechanisms that extend beyond individual discovery, ultimately providing support for the emergence of symbolic communication and language.³⁷

Joined attention appears towards the end of the first year and is characterized by the infant's ability to coordinate the center of their focus with another person in relation to a shared object or an event. Before this, interactions with the environment are mostly individual, but the ability to participate in contexts involving joined attention introduces a new learning situation in which experiences are organized in collaboration. Tomasello did acknowledge Chomsky in his work, but he proposed that these accounts that centered primarily on grammatical competence have their limits in explaining how children begin to participate in communicative exchanges in the first place. In explanations that view the origins of language in relation to the development of social cognition, especially the capacity to share attention with others, Tomasello connects these shared contexts to children beginning to use communicate gestures and vocalization that function symbolically, since both communication partners understand their purpose.³⁸

³⁷ Ibidem.

³⁸ Ibidem.

An important achievement in development is a process of role-reversal imitation, the ability to reproduce the action from the perspective of another person while recognizing the underlying goal structure. Through this kind of imitation, the child does not copy the behaviour but it also internalizes the communicative intention and organizes it. This enables the participants in a communicative exchange to alternate between the roles of speaker and listener, and over time, these interactions lead to the conventionalization of communicative forms, a process through which initial signals bound to context are transformed into stable linguistic symbols and can be used flexibly across situations.³⁹

To begin the comparison between Tomasello and Chomsky, let's take a look at how they approached the connection of evolution and language. Tomasello explains how biological differences between humans and other primates are not that big, so such amount of genetic divergence would be insufficient to explain the expansion of both human cognition and communication. He locates this evolutionary shift in the appearance of forms of interaction that are unique for the human species, especially shared intentionality between individuals and the mentioned cultural transmission, in a context of communicative systems gradually increasing in how complex they are across many generations.⁴⁰

Chomsky together with Berwick contrasts this position and treats language as a biological capacity whose essential property is hierarchical syntactic combination, and it may have arisen through a small genetic innovation that reorganized pre-existing cognitive

³⁹ Ibidem.

⁴⁰ Ibidem.

resources and structures. They believed that the most important quality of human language is syntax, which comes from a mental operation they call Merge.⁴¹

Merge is the capacity of the brain to combine two elements into a larger structure and can continue infinitely leading to recursion. They considered that this ability appeared because of a small biological change in human evolution, with the brain already having perception, memory and motor control, one new addition and change allowed symbolic combination and language emerged as a product of it. Therefore, their view is that humans did not slowly learn language through cultural processes, but that brain changed in biological ways that facilitated language acquisition and made it possible.⁴²

Both Tomasello and Chomsky begin from the same evolutionary observation, that modern humans developed from previous population within a relatively short time frame, but the difference lies in the fact that they interpreted the significance of this transition in quite different ways. Tomasello's argument was that although many anatomical and neurological changes happened and led to *Homo sapiens*, a very important transformation concerned the appearance of new forms: social organization and cultural activity. The uniquely human cognition was able to develop under cultural processes and cumulative cultural affects, allowing for the development of language across generations. Contrasting, Chomsky and Berwick view the evolutionary path of *Homo* as a reflection of the emergence of a biological capacity specialized for language that altered the human cognition. If language is seen as mainly an internal computation, evolution only really needed one biological change that enabled hierarchical combination, not a long cultural

⁴¹ Robert C. Berwick, Noam Chomsky, *Why Only Us: Language and evolution*, MIT Press, Cambridge (MA) 2016.

⁴² Ibidem.

process. Through their lens evolution becomes simpler to explain and their theories reduce the “Darwinian paradox”.⁴³

For the next debate, we will consider Tomasello’s and Chomsky’s theories in the light of how language becomes acquired. It is useful to recall Chomsky’s framework, proposed in “Aspects of the Theory of syntax”, in which linguistic competence is considered to develop under biological constraints that limit the range of grammar a child may consider. Input is often imperfect and limited; and success in acquisition happens under an innate system that sought to guide hypothesis formulation. Accordingly, the goal of linguistic theory is to explain and account for how children obtain the knowledge that moves beyond the information directly available to them in experience. Acquisition is conceptualized mostly as a process of selection among possibilities already available in the internal system, instead of construction from external input.⁴⁴

Tomasello challenges these assumptions by questioning if abstract grammatical knowledge must be present from the “outset” at all. Empirical findings he draws from suggest that early linguistic behaviour in child development is highly dependent on communicative contexts, and children are not seen as initially operating with generalized syntactic categories. Instead, children begin with item-based constructions tied to particular words (or expressions) and then slowly and gradually form patterns that are broader, through the process of similarities across utterances heard from experience accumulating. This perspective is based on usage of language and it views linguistic knowledge as emerging from general processes in cognition, for example categorization,

⁴³ Berwick, Chomsky, *Why Only Us*; Tomasello, *The Cultural Origins of Human Cognition*, op.cit.

⁴⁴ Chomsky, *Aspects of the Theory of Syntax*, op.cit

analogy, or detection of patterns in linguistic input, that operates over stored linguistic input, so the child doesn't select from a pre-existing universal grammar in this view, it constructs grammatical representations over time.⁴⁵

According to Tomasello, if grammatical knowledge was fully specified by principles that were innate to children, children should then demonstrate rapid generalization once they gain relevant structural rules, but the evidence he reviewed and discussed indicated that children's production could often remain restricted in the lexical sense for extended time periods, with generalization occurring quite unevenly across different constructions. Omissions or errors, however, are not treated as a child's failure to access innate rules. They are treated as a part of a learning process that is sensitive to characteristics of input and its frequency. Moreover, abstraction is treated as a developmental achievement that emerges as children accumulate experience that is sufficient across various linguistic contexts.⁴⁶

Another contrast concerns the role of words in child's acquisition. For Chomsky, lexical items are put into syntactic structures generated by underlying principles of grammar, so for him words are components of a larger system run by rules. For Tomasello, constructions, pairings that can reach from a singular word to a large complex pattern, are fundamental language learning units. According to him, children learn words and grammar patterns together as integrated units that carry symbolical meanings through communicative use. Vocabulary is not acquired separately and independently from syntax, linguistic forms are learned within social exchanges and grounded in

⁴⁵ Michael Tomasello, *Constructing a Language: A Usage-based Theory of Language Acquisition*, Harvard University Press, Cambridge (MA) 2003.

⁴⁶ Ibidem.

communicative interactions, not from purely structural computations. Chomsky also presented the previously mentioned and famous fact of speakers being able to make an infinite number of sentences with a finite number of words and elements as evidence that there is an underlying rule system for this productivity of language. Productivity is not denied by Tomasello, but it is explained differently. He states that through children's repeated exposure to constructions that are similar, they start to develop schematic patterns that they can extend to new utterances without requiring those pre-specific grammar rules. In that case, productivity becomes comparable to experience-based models of learning.⁴⁷

In summary, the debate between their approaches shows different positions and assumptions about the relationship between biology, cognition, experience, and social interactions. While both perspectives acknowledge there are biological constraints on language learning, they differ in the level to which linguistic knowledge needs to be specified prior to experience. Nevertheless, both of their views have significant implications for understanding language acquisition and development.

Although the task facing the young child is immense and requires mastery of thousands of words and ability to combine them in order to express the desired meaning, most children achieve this without formal instruction. Born without the actual knowledge which language they must learn, children do a great job at attuning themselves to whichever linguistic structures are present in their environment. Some are even exposed to more than one language, whether the cause of that being that they were born into a

⁴⁷ Tomasello, *Constructing a Language*; Chomsky, *Aspects of the Theory of Syntax*, op.cit

country where two languages are spoken, or that their primary caregivers speak different languages like in the case of intercultural couples. Language learning surely doesn't occur in isolation but rather unfolds in an environment where active engagements with caregivers and others exist. Through these communicative exchanges in which the children actively participate every day, they gradually build extensive vocabularies containing close to one thousand words which they can use in various ways to build sentences guided by complex grammar rules. They are also enabled to distinguish humor, metaphors, and use their knowledge to support emerging literacy skills.⁴⁸

Another perspective on language learning has emerged from connectionists, which approach language as a dynamic outcome of learning within networks that resemble basic features of the human brain, which we will examine more closely in the next subchapter. In these models, language processing is simulated through a large number of simple and highly interactive units that function in a manner analogous to neurons.⁴⁹

This view aligns with Corballis' and Tomsello's views in a way that rejects the idea that language is required or even represented as a fixed set of abstract rules that are fully specified in advance and supports the idea that language slowly emerges from the interaction with experience. Corballis argues that language begun with gesture and only later became fully vocal, emphasizing the tone of social interaction and cultural context, and transmission in shaping linguistic structure. Similarly, connectionist models treat language as a product of learning within networks that adapt over time in response to

⁴⁸ Heidi M. Feldman, *How Young Children Learn Language and Speech: Implications of Theory and Evidence for Clinical Pediatric Practice*, in "Pediatrics in Review", 40 (2019), pp. 398–411.

⁴⁹ Marc F. Joanisse, James L. McClelland, *Connectionist Perspectives on Language Learning, Representation and Processing*, in "Wiley Interdisciplinary Reviews: Cognitive Science", 6 (2015), pp. 235–247.

environmental input. This shared, learning-based approach offers us an explanation on how exactly children are able to acquire any language they are exposed to, regardless of the specific structure of the language. Learning itself occurs as the connections between the units change in response to repeated exposure to language, allowing the system to become sensitive to patterns in the input and over time, these patterns give rise to more stable representations of linguistic knowledge. Put another way, connections grow stronger to the sounds that appear together and patterns that repeat become familiar, while more rare combinations fade away.⁵⁰

This could potentially explain how language doesn't emerge perfectly, but rather gradually and through exposure. Despite the shared general view and alignment, there are some differences in these approaches. Corballis focuses on why language took the form it did, addresses questions about the evolutionary origins of language and the transition from gesture to speech, while mentioning biological and cultural aspects. He mainly operates on a broader explanatory level and integrates evidence from evolution, child development, and neurobiology. In contrast, connectionist approaches focus on how language learning and processing can be implemented on a brain-like system and rather than addressing evolution and child development facts, they address computational learning principles.⁵¹

Learning based approaches, such as those of connectionist or evolutionary approaches that emphasize gesture and social interaction, propose the gradual emergence of language. Another perspective is proposed by Eric Lenneberg, who argued that linguistic

⁵⁰Joanisse, McClelland, *Connectionist Perspectives on Language Learning*; Corballis, *From Hand to Mouth*, op.cit.

⁵¹ Ibidem.

development follows patterns that are characteristic of biologically regulated processes, as opposed to cumulative learning. The onset of speech occurs in a relatively stable and similar timeline, hence internal growth factors could be the ones taking a primary role despite environment variation each individual has. Many complex behaviours appear at the moment in which the organism reaches an appropriate stage of development, which suggest that the central factor could be the underlying potential. Therefore, the appearance of speech can be understood as the unfolding of capacities that are already prepared biologically and become available when the child reaches the appropriate level of maturation.⁵²

If, according to connectionists, language is just learning through adaptive networks, the existence of a biological critical period raises an important question: why would the capacity for language learning decline with age if the underlying mechanisms are general and could be continuously modified? Lenneberg refers to a developmental trajectory, that early childhood represents a period with a high neural flexibility that reduces its adaptability after puberty, a window specific to language and not to general intelligence. He presents evidence from aphasia recovery patients to demonstrate how children recover language after brain injury more easily and sometimes even relearn their language from zero, while adults persistently show deficits or have a more limited recovery. The existence of limitations that are related to age, especially this decline in learning capacity, indicates that neurological maturation shows constraints that cannot be explain only in the account of exposure and communicative experience individuals encounter.⁵³

⁵² Eric H. Lenneberg, *Biological Foundations of Language*, John Wiley & Sons, New York 1967.

⁵³ Ibidem.

Lenneberg's opinion could naturally be connected back to Chomsky, since he viewed Lenneberg's work as the core of the biolinguistic perspective, where language is treated as a component of the human mind that has its roots in brain organization, Chomsky acknowledged his work as foundational for approaching language in a biological framework, from which point a big question was which exact aspects of linguistic structure are specific to this biological system and how do they appear during development. Shifting the focus toward the internal structure of the language faculty, Chomsky proceeded to extend Lenneberg's argument beyond maturation and critical periods.⁵⁴

A significant contribution of biolinguists is a previously mentioned proposal that language acquisition is better understood as a kind of biological growth, than as a kind of more traditional learning. Chomsky describes learning mechanisms as systems that exist in the brain and reach particular stages with the influence of triggering environmental input. From that standpoint language exposure does not build linguistic competence, but triggers the unfolding of processes in line with pre-existing constraints, an interpretation that resonates with maturation.⁵⁵

The biological concept of canalization could provide an explanation of the remarkable level of stability of language acquisition across different individuals in different environments. Originally developed by Waddington, canalization is a process that explains how biological development is not infinitely flexible, and organisms instead develop along preferred pathways, tending to lead to stable outcomes even when other

⁵⁴ Noam Chomsky, *Language and Mind*, Cambridge University Press, Cambridge 2006.

⁵⁵ Ibidem.

conditions vary. He did not disregard environment as irrelevant, instead he proposed environment can have an influence and effect on which path is created, but outcomes do remain constrained.⁵⁶

Chomsky interprets language acquisition in each individual as a canalized developmental process, in this process biological mechanisms can constrain the range of possible outcomes and lead children towards linguistic systems that's typical for the species, despite input variability. The discussion of these developmental constraints extends beyond the growth of a singular individual, to growth in terms of evolution. The emergence of language may also be shaped by properties of human biology specifically, that restricts the range of possible outcomes. Therefore, if both development and evolution function with these constraints, language could be the product of a cognitive system that is to a great degree specialized and whose organization, as discussed, goes in line with principles of biology and evolution.⁵⁷

Such a view strengthens claims that language depends on species-specific resources in cognition, since, for example, the ability to construct conceptual categories is an ability rooted in the human mind and seemingly not directly derived from sensory experience. Chomsky's argument complements biological arguments that suggest that what matures in development is not just the capacity to produce speech, but also the internal system that guides interpretation and thought.⁵⁸

⁵⁶ Conrad Hal Waddington, *Canalization of Development and the Inheritance of Acquired Characters*, in "Nature", 150 (1942), pp. 563–565.

⁵⁷ Chomsky, *Language and Mind*, op.cit.

⁵⁸ Ibidem.

This theoretical discussion provides a solid framework for examining the neural systems that enable language learning and processing in the human brain.

1.3. Where Language Meets the Brain

Language does not exist independently of the biological system that enables it. While many different theoretical approaches try to explain the why and the how of language emergence, they ultimately rely on the brain structures that support and allow the processing of linguistic cues and speech production. Understanding language requires an examination of the neural architecture that makes language acquisition, comprehension, and production possible.

Research on the relationship between language and the brain dates to the nineteenth century with clinical investigations conducted by Paul Broca and Carl Wernicke. Their work focused on individuals who had experienced language impairments following brain damage, allowing them to associate specific linguistic difficulties with damage to brain regions. Through post-mortem examinations, they identified two distinct cortical areas found in the left hemisphere of the cerebral cortex and later named Broca's area and Wernicke's area. These areas were initially identified through observations of patients with aphasia, but advances in brain imaging techniques have since confirmed their involvement in language processing in healthy individuals as well. Each of these areas is associated with different aspects of language use.⁵⁹

⁵⁹ Kinley Dorjee, *Understanding of Neurolinguistic Development in Early Childhood and its Implication to Early Child Care*, in "International Journal of English and Literature", 6 (2015), pp. 69–74.

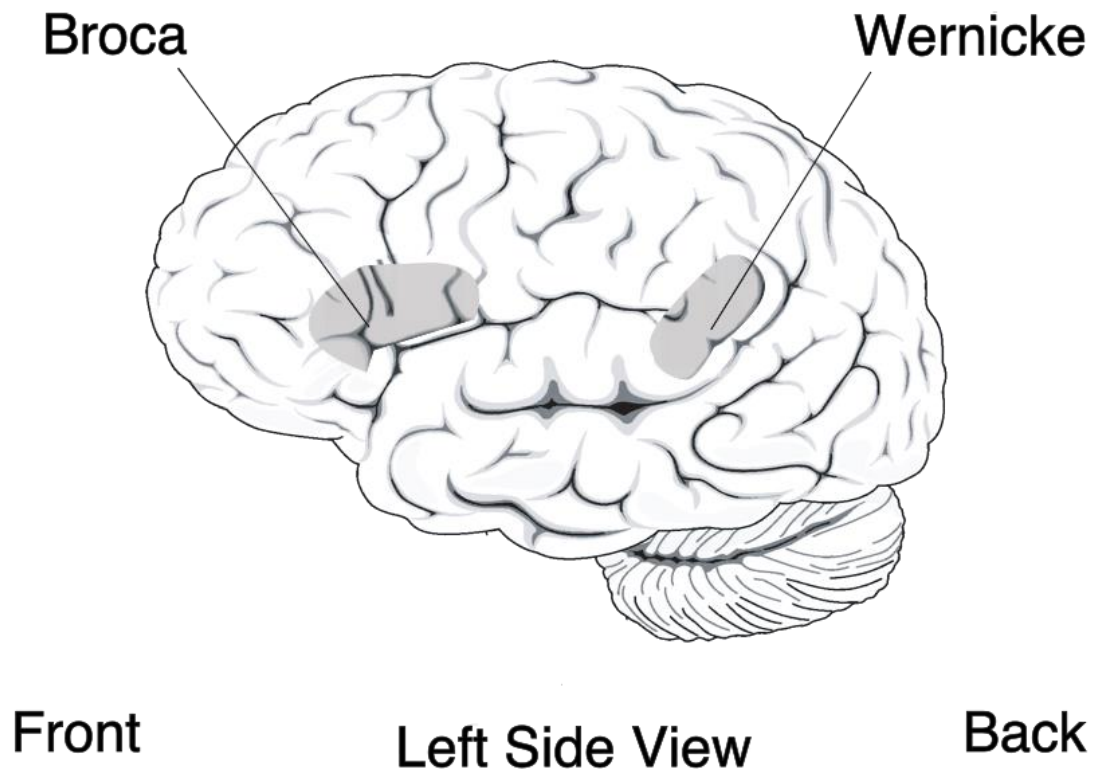


Figure 1: *Diagram showing Broca's area and Wernicke's area in the human brain.*
Public domain image from NIH/NIDCD (source file courtesy of Wikimedia Commons)

The left hemisphere of the cerebral cortex plays a central role in language, thought and higher cognitive functions and for the majority of individuals, especially those who are right-handed, language functions are predominantly localized in the left hemisphere. Some variations may occur and some individuals might show right-hemisphere or even bilateral involvement. Wernicke's area is situated in regions responsible for auditory processing and it plays a key role in language comprehension, as well as in accessing vocabulary during speech. In contrast, Broca's area is located closer to regions involved in motor control and contributes to the organization of grammar, including the use of

function words, and also affixes. It's also involved in regulation of intonation and coordination of the fine muscular movements required for speech production.⁶⁰

Having in mind all of these facts, it's important to remember that language emerges not only from specialized regions, but from the communication between them. To fully understand the functioning of these regions, we must also examine the pathways that connect them. The functional relationship between Broca's area and Wernicke's area is supported by their anatomical connection supported by a bundle of nerve fibers known as the arcuate fasciculus, which links language comprehension to language production. This brings up the question: how is speech actually produced in the human brain?⁶¹

During listening, auditory information is processed and interpreted in Wernicke's area, while during speech production, lexical information is transmitted to Broca's area, integrated into grammatical structures and translated into motor instructions for speech. A rather similar pattern of processing applies when language is conveyed through visual means, such as sign language. Damage of any component of this complex network typically results in predictable language difficulties, which further reinforces the idea that language functions are localized within specific brain regions. Later developments in neuroscience, specifically ideas proposed in the mid-twentieth century, expanded early models of how exactly language is structured in the brain.⁶²

Building on the principle of localization, which presumes that specific language functions are associated with particular brain regions, Norman Geschwind proposed that language

⁶⁰ Ibidem.

⁶¹ Ibidem.

⁶² Ibidem.

depends on a network of specialized, yet interconnected areas. Early aphasia research encouraged the idea that language functions were restricted to distinct cortical centers, Geschwind did not reject the principle of localization itself, but argued that on its own is incomplete when applied to the complexity of language. His work suggested that higher functions depend on multiple areas that interact with each other through anatomical connections. This newer view based on networks remains equally influential in current classifications of language areas and different forms of previously mentioned aphasia.⁶³

A central point in Geschwind's proposal was the concept of disconnection. He demonstrated that neurological symptoms could arise from both damage to functional areas and from the damage of pathways that usually carry information between them. This approach shifts the focus from isolated centers, toward networks of interacting regions, while preserving the importance of anatomical localization.⁶⁴

At the same time, research has shown that language is also shaped by lateralization, meaning that in most individuals, language functions are predominantly located in the left hemisphere of the brain. Advances in brain imaging technologies such as MRI, CAT and PET scanning have allowed researchers to observe brain activity in healthy individuals during tasks like speaking, listening, and reading. These methods have confirmed earlier findings about the localization and lateralization of language, while also providing a more detailed and well-rounded picture of how different regions interact within the language network.⁶⁵

⁶³ Norman Geschwind, Disconnection Syndromes in Animals and Man, in "Brain", 88 (1965), pp. 585–644.

⁶⁴ Ibidem.

⁶⁵ Dorjee, *Understanding of Neurolinguistic Development*, op.cit.

In addition to this, anatomical organization plays a critical role because each hemisphere processes sensory input and controls movement from the opposite side of the body. This is because many nerve fibers cross over in their path of descending through the brain stem, offering us an explanation of why damage to one side of the brain produces physical effects on the contralateral side and further illustrating how neural structure shapes language and motor functioning.⁶⁶

The organization of the brain certainly provides the foundation, but development builds upon it. In the first years of life, neural connections expand and adapt, further shaping the systems that support language and thought. In infancy, early brain development is characterized by the rapid growth of a network of neural connections. Although a baby is born with all the brain cells it will need, these cells must establish connections with one another, so they can function properly and effectively. These connections are formed through branching structures called dendrites. Dendrites link neurons at contact points known as synapses and when particular pathways are activated repeatedly, the connections involved become increasingly efficient and stable.⁶⁷

In early life, the brain produces far more connections than what will ultimately retain, further creating a dense and highly-flexible neural system. This period of synaptic overproduction occurs especially rapidly around birth, and also, in the following couple of months, resulting in a brain of the newborn that contains many more connections than the connections that an adult brain has. However, over time this surplus is reduced through a process we call selective elimination. This allows the most frequently used

⁶⁶ Ibidem.

⁶⁷ Ibidem.

connections to be preserved while others are gradually weakened or even removed. The process of growth and reduction of connections doesn't occur at the same pace across all brain areas. Regions involved in sensory processing develop quite early and reach their peak levels of connectivity within the first months of life, while other areas responsible for language and hearing follow somewhat later. Regions that operate at a higher level and are associated with more complex thinking and self-regulation mature at a slower pace, with changes continuing well into adolescence.⁶⁸

An important fact to keep in mind is that the pattern of which connections are kept and which end up being discarded is not random. Instead, it reflects the child's experiences, as repeated activity strengthens certain neural pathways and stabilizes them over time. As a result, the brain becomes increasingly shaped by the child's environment. The idea that neural connections are molded by the child's environment is consistent with broader arguments introduced earlier, in which both connectionist models and evolutionary perspective of Corballis describe language as arising from repeated use and interaction. All of these views converge on the idea that linguistic knowledge is built through changes in underlying neural systems that are driven by experience, which therefore plays a central role in shaping how the developing brain is organized. Interaction with the world around us, including sensory input, movement, and social engagement all influence which neural circuits are reinforced. Parents in particular have a powerful impact through the language they use, emotional exchanges that occur with their children, and stimulation they provide. When stimulation is limited or inconsistent, some neural pathways may fail to develop fully. Learning itself, including the acquisition of language, contributes to the

⁶⁸ Ibidem.

creation and growth of synapses, especially so in the cerebral cortex. This dynamic relationship between experience and brain development is the main reason that early life is considered a period of heightened sensitivity. From this perspective, the newborn brain cannot be understood as a predetermined structure that simply matures over time, but as an organ shaped by early experiences and ongoing interaction with its environment.

Even at birth, patterns of neural organization reflect an interplay between biological development, and exposure to sensory and linguistic input. This view is supported by recent evidence showing that the functional architecture of the brain is already organized in a meaningful way in the neonatal period, the study by Canini and colleagues could be of particular interest as it examines how patterns of functional connectivity at birth are related to later cognitive development, language development and socioemotional development. Over the past decades, developmental neuropsychology has shown that the way the brain is organized at birth is meaningfully related to how children develop later, which is especially relevant for preterm birth, already known to be associated with a higher risk of developmental difficulties.⁶⁹

A range of conditions, some maternal, some fetal and some perinatal, including birth complications or low birth weight, have been identified as factors that can compromise early brain development. Although the introduction of structural MRI into neonatal care has improved the discovery of brain injuries, it also highlighted a limitation that not all developmental risks are visible in brain structure. Severe lesions often lead to clear

⁶⁹ Matteo Canini, Cristina Cara, Claudia Oprandi, Ana Katušić, Iris Žunić Išasegi, Antonio Messina, Alberto Andrea Zambon, Nicolò Pecco, Sarah Barni, Antonella Poloniato, Maria Grazia Natali Sora, Monica Falautano, Paola Scifo, Graziano Barera, Marco Tettamanti, Andrea Falini, Cristina Baldoli, Pasquale Anthony Della Rosa, *Functional Connectivity Markers of Prematurity at Birth Predict Neurodevelopmental Outcomes at 6, 12, 24, and 36 Months*, in “International Journal of Behavioral Development”, (2025), pp. 1–16.

impairments, but subtler disruptions can often go undetected in the perinatal period and become apparent only later in childhood, doing so in the form of difficulties in attention, memory, emotional regulation or language. For this reason, resting state fMRI, has emerged as a solution, since functional networks build up on the developing brain, and their organization may reveal disruptions that were not detected anatomically. Additionally, variability in functional connectivity may be linked even closer to later developmental trajectories than just structural measures alone. Even preterm infants without visible brain damage show differences in the organization of resting-state networks, and functional connectivity patterns have been used to distinguish preterm from full term newborns.⁷⁰

The findings of this study showed that specific patterns of functional connectivity at birth were systematically related to later development, with different networks predicting different outcomes at different ages. Prematurity was associated with a broad reorganization of the brain functions of the newborn, rather than isolated changes in each individual brain region. Eight major functional systems were identified at birth: cerebellar, sensorimotor (thalamo-striatal and somatosensory motor), visual, memory, auditory-language, emotional control, and higher-order cognitive networks.⁷¹

Alterations were observed both in the systems and between them, suggesting that prematurity affected the overall pattern of communication of the brain yet to be fully developed. Specific patterns observed were linked to different cognitive, language, socioemotional outcomes across the first three years of life, and two predictors were

⁷⁰ Ibidem.

⁷¹ Ibidem.

especially influential over time. Stronger connectivity between the two cerebellar hemispheres, alongside a strong coupling between auditory-language and emotional control regions, were associated with better neurodevelopment overall, with higher-order control areas being related to lower scores at 12 months. Furthermore, cerebellar connectivity predicted socioemotional functioning at six months, visual connectivity predicted cognition at twelve months, and integration between auditory-language regions and the insula predicted socioemotional development at the same age. By the ages of two and three, stronger integration between sensorimotor and higher-order cortical systems predicted cognition and language.⁷²

These findings could lead to an important question about the relationship between early organization of the brain and learning that occurs later in life: if patterns of functional connectivity at birth already predict how children will develop, to what extent are they fixed and to what extent are they shaped by the infants' experiences after birth? The results from the study done by Canini and colleagues suggested that the neonatal brain is not a blank slate and early functional networks appear to provide a foundation, while not implying that further development is completely predetermined.

The interplay between biology and environment continues to be our topic of interest, where initial neural organization could be strengthened, refined, reshaped or even transformed through interactions with the world and experience that they provide. Exposure to spoken language that infants will experience in their first year of life allows them to distinguish speech sounds and gradually learn exactly how those sounds are organized. Drawing from the paper written by Dorjee, the amount and the quality of input

⁷² Ibidem.

that a child receives can therefore influence not only what is learned, but also how the brain becomes structured. Enriching experiences are likely to support stronger and more efficient neural networks, whereas deprivation of stimulation or the lack of it may affect both cognitive development and the organization of brain itself. In this way, early experience potentially doesn't just fill a brain that is already formed with new information, but could rather actively participates in shaping the neural architecture that makes learning possible.⁷³

A particular attention is given to Broca's area, suggesting that its role extends beyond language alone and includes the organization of purposeful movement and action planning. Damage to the Broca's area disrupts articulate speech even when comprehension remains intact, and it is also involved in processing sentence structures. Corballis shows that the brain itself underwent big changes that made complex communication that we use today possible. Human speech requires the coordination of close to one hundred muscles that move at a remarkable speed, which itself would not be impossible without the involvement of the highly folded outer layer of the brain called the cerebral cortex. These neural changes were not limited only to motor control, but were rather accompanied by a dramatic expansion of the cortex itself. The human brain is notably larger than the brain of other primates, especially the frontal lobes that are responsible for planning and short-term memory. This increased size and wrinkling allowed more neural surface, supporting the mental capacity required to handle long and

⁷³ Dorjee, *Understanding of Neurolinguistic Development*, op.cit.

structured utterances. In this way, we can note that the architecture of the brain itself reflects the demands of language.⁷⁴

Whether linguistic structure is assumed to be innate, or assumed to have emerged from usage, both perspectives presuppose that there are existing biological capacities that would make vocal communication possible, with physical production of speech depending on motor systems. From this point, proposals that evolutionary origins of speech production may be rooted in already existing oral behaviours emerged.

One of these proposals on the origins of speech comes from Peter MacNeilage, who suggests that vocal communication evolved from the repetitive jaw and mouth movements involving eating. These cyclical motions form the foundation for early vocal behaviour in infants. When babies begin babbling, they engage in opening and closing of the vocal tract, a movement which they tend to repeat and that mirrors the patterns seen in mastication. As they repeat it more and more, over time, this activity is gradually shaped and modulated, further giving rise to the varied syllables that mark speech, such as the transition from simpler repetitions like ba-ba to ba-bee. By the time they are two years old, this early kind of experimentation with sounds is further followed by vocabulary expansion and combination of words into sentences.⁷⁵

As speech continued to develop, it placed new demands on the brain. Producing speech is a complex action that is far more than linguistic planning and depends on the precise coordination of multiple physiological systems. Even a repetition of a short, simple phrase

⁷⁴ Corballis, *From Hand to Mouth*, op.cit.

⁷⁵ Paul F. MacNeilage, *The Frame / Content Theory of the Evolution of Speech Production*, in "Behavioral and Brain Sciences", 21 (1998), pp. 499–546.

involves regulation of breathing, vocalization, and the movement of articulatory muscles. Neuroimaging research has shown that these components are all supported by a distributed network of brain regions, including the motor and sensorimotor cortices, the cerebellum and subcortical structures such as the thalamus. Together, they contribute to timing, control and coordination and become active even when language processing at a higher level is minimized, further demonstrating that the basic act of speaking relies on neural systems that are dedicated to motor and respiratory control. This activity can be found in both brain hemispheres, indicating that physical production of speech is in fact not limited to traditional language areas, or even to the left hemisphere alone.⁷⁶

In summary, all these perspectives taken together present language as a capacity grounded in an interconnected brain that has been shaped both by evolution, biology, developmental neuroscience and by experience. Corballis' evolutionary perspective show how neural systems originally devoted to gesture and action were gradually reorganized into networks that now support language, including Broca's and Wernicke's areas. The neuroanatomical and developmental evidence further demonstrates that these regions don't function in isolation, but as a part of a wider system of sensory, motor and associative areas. The connections of these areas are strengthened and sometimes pruned across early childhood. As the brain grows through repeated patterns, linguistic input becomes one of the most powerful forces as the neural foundations of language reflect the history of a child's communicative environment. This makes maternal speech and

⁷⁶ K. Murphy, D. R. Corfield, A. Guz, G. R. Fink, R. J. S. Wise, J. Harrison, L. Adams, Cerebral areas associated with motor control of speech in humans, in "Journal of Applied Physiology", 83 (1997), pp. 1438–1447.

everyday engagement in communication central to the shaping of the developing language brain, leading us to the focus of the next chapter - maternal input.

Chapter 2 : Foundations of Maternal Language

2.1. Importance of Maternal Input and it's Prenatal Roots

In the previous chapters we have explored language as a system that grows through interaction, therefore, it cannot be separated from the people who first speak it to the child. The earliest conversations between infants and their caregivers become a central site where language emerges and takes shape. Seen in this light, it is especially interesting that exposure to language begins even before birth. Research on fetal responsiveness shows that unborn infants can distinguish familiar from unfamiliar sounds, including rhythmic patterns from stories or even rhymes that were repeatedly heard during pregnancy.⁷⁷

Using changes in heart rate as an indicator of attention, it's suggested that the auditory system is already tuning itself to the environment long before the child even begins to speak. The foundations of language seem to be laid down even well before birth, the fetus' brain starts to gradually organize itself around auditory and language related-networks during the third trimester. The auditory system starts to take shape very early in gestation, from the formation of the inner ear to the maturation of brain stem pathways, to later the auditory cortex in the temporal lobe. By the final pregnancy trimester, key regions, such as Heschl's gyrus and the planum temporale are visible and begin to display subtle hemispheric asymmetries, while areas around the Sylvian fissure in the frontal lobe and the temporal lobe slowly assemble, how authors call it, a primordial language network.

⁷⁷Roberta Michnick Golinkoff, Kathy Hirsh-Pasek, *How Babies Talk: The Magic and Mystery of Language in the First Three Years of Life*, Plume, New York 1999.

The white matter tracts that will eventually link these regions are present, but in this phase of development still immature, so we can conclude that the bases are laid down before birth but continue to develop further and refine after it. This network usually forms in the following milestones: the Sylvian fissure begins to be detectable at around 20 weeks, the insula begins to fold shortly after and by the time of 24 to 25 weeks the superior frontal sulcus has matured enough to be able to support the formation of subdivision of the inferior frontal gyrus. In the temporal lobe, the superior temporal sulcus and gyrus take shape during the same time period and steadily become more and more complex, with secondary and tertiary folds appearing throughout the third trimester.⁷⁸

Important to note is that Ghio and colleagues emphasize that functional connectivity also emerges prenatally, with large-scale brain networks starting to synchronize around 26 weeks to 29 weeks, first in posterior regions and gradually spreading towards temporal areas and frontal areas, associated with sound and language. In line with these facts are the findings already mentioned in the last chapter by Canini and colleagues, which demonstrated how these functional networks that emerge in the prenatal stages continue to organize and develop after birth, predicting later outcomes. Besides this construction of early language networks, evidence shows that the fetal brain is already capable of more than just a sound detection, in fact, from the third trimester onward, they show signs of discriminating between different acoustic signals. The presence of these different kinds of responses in fetuses indicate that their early auditory system is capable of forming short-term memory, as it retains a previously heard sound so it can recognize how a new

⁷⁸ Marta Ghio, Cristina Cara, Marco Tettamanti, *The Prenatal Brain Readiness for Speech Processing: A Review on Foetal Development of Auditory and Primordial Language Networks*, in “Neuroscience and Biobehavioral Reviews”, 128 (2021), pp. 709–719.

sound differs from it. This emerging capacity for memory and discrimination doesn't develop in an isolated way, but within a sensory environment far from silent or empty.⁷⁹

The intrauterine environment is not as silent as we might imagine it, but is rather acoustically active environment, that contains a constant mixture of sounds of the mother's body, such as her heartbeat, breathing and movement, amongst which the voice of the mother stands out as especially prominent. Because the mother's voice reaches the fetus both through air and vibrations that travel through her body, it is less 'muffled' than other external sounds and retains important rhythmic and melodic features such as pitch and stress patterns. These acoustic properties provide the fetus with rich information about speech long before it is able and ready to start producing sounds itself. Studies of fetal responses show that when mothers speak aloud, fetuses don't react in a random pattern but rather show organized patterns of attention, reflected through mentioned changes in heart rate and movement. As previously mentioned in the study done by Ghio and associates, fetuses respond differently when a familiar pattern is changed and adjust their movement and heart rate accordingly. In particular, many fetuses reduce their physical activity and show signs of cardiac slowing when the maternal voice begins. In other words, the fetus is not just hearing the mother's voice, it's noticing and tuning into it. An important thing to note is that this is not a fixed response for every infant, but depends both on the fetus' physiological state and what the mother was doing just before she began to speak.⁸⁰

⁷⁹ Ibidem.

⁸⁰ Kristin M. Voegtline, Kathleen A. Costigan, Heather A. Pater, Janet A. DiPietro, *Near-term Fetal Response to Maternal Spoken Voice*, in "Infant Behavior and Development", 36 (2013), pp. 526–533.

When mothers were already awake and talking, the shift to reading aloud created a noticeable change in their speech rhythm and intensity, leading their fetuses to respond with focused attention. In contrast, when mothers moved from silence to speech, the very sudden change in the sound environment produced a different reaction similar to a startle. These differences highlight that the learning of the fetus occurs in a dynamic context shaped by the readiness of the fetus itself and the behaviour of their mother. Over repeated exposures, the distinctive qualities of their mother's voice, such as their rhythmic and melodic patterns, become familiar to the fetus and support the development of postnatal recognition preference.⁸¹

With time, interest in fetal responses to sounds has grown alongside huge technological advances in prenatal imaging, particularly the development of higher resolution 3D and 4D ultrasound. These techniques have made it possible to observe the fetus in real time, while capturing movements and facial expressions, previously often too difficult to detect with older methods. As we already established, the womb is an environment full of different sounds, some from the mother's body itself and some from external sources, but how do exactly do these external sounds get to the fetus? ⁸²

External sounds must pass through maternal tissues and amniotic fluid, which can considerably distort them before they reach the fetus, which leads us to the conclusion that not all sounds presented to the mothers are experienced in the same way by the fetus and these sound differences in intensity and quality of the sound may influence fetal reactions. For example, very loud and intense external sounds can get “muffled” to the

⁸¹ Ibidem.

⁸² Marisa López-Teijón, Álex García-Faura, Alberto Prats-Galino, *Fetal Facial Expression in Response to Intravaginal Music Emission*, in “Ultrasound”, 23 (2015), pp. 216–223.

point of reaching a level of ordinary conversation, or maternal voice can get reduced to the point seeming like a very quiet one. These limitations have led researchers to the use of alternative methods of delivering the sounds to the fetus, such as intravaginal acoustic devices. These devices place the sound source closer to the fetus and reduce the interference from the mother's body, opening new possibilities for examining how fetuses respond through music and vibrations, not only through physiological methods such as heart rate that was already mentioned in the previous studies, but also through observable movements and facial behavior on ultrasound.⁸³

Pregnancies were divided in a way that distinguished fetuses in four groups, but with the most important distinction being those younger than 16 weeks, considering their lack of functional hearing, from those older than 16 weeks who were presumed capable of such auditory perception. From that point, fetuses were assigned one of three conditions, either music delivered through abdominal headphones, the same music delivered via an intravaginal device or just intravaginal vibration alone. Ultrasound recordings captured three phases, a baseline one, five minutes of stimulation and five minutes of silence, while observers analyzed fetal activity and coded facial movements such as mouthing or tongue protrusion.⁸⁴

The results revealed a clear developmental pattern, fetuses under 16 weeks showed very little change in behavior in any conditions, while fetuses older than 16 weeks reacted quite strongly, but only to intravaginal music. The route of delivery seemed to matter as much as the sound itself. Abdominal music, despite being louder at the source, likely lost

⁸³ Ibidem.

⁸⁴ Ibidem.

too much intensity while passing through the tissues of mothers' bodies, while intravaginal stimulation reached the fetus with a lot less acoustic obstacles. In the intravaginal stimulation group, most fetuses increased their movements and displayed mouthing, while nearly half protruded their tongues and these responses persisted even after the stimulus ended, followed by a slight increase in the heart rate of the fetus.⁸⁵

This study reveals not only that fetuses respond to intravaginal music, but also that the type of response raises a question about how perception and action are connected even before birth. The fact that tongue expulsion was absent at baseline, but appeared during intravaginal music, suggests that it's unlikely to be spontaneous and seems to be tied to the way that sound reaches the fetus. Even though the vibratory stimulus fell within a range that according to some existing literature fetuses should be able to perceive, it failed to trigger the same kind of response, which could be an implication that fetuses are not just sensitive to sound and source, but also to the patterned organization of the sound.⁸⁶

The authors linked the responses of mouth and tongue movements to primitive brain circuits, involved in phonation and also oral movements, proposing that the fetus is not only listening, but may also be engaging in sensorimotor loops rather than relying on pure reflexes. These movements suggest that the fetus may already be linking auditory input with patterned motor activity in the mouth. This could be particularly relevance since after birth, one of the first ways infants show purposeful control through their mouth is by sucking behavior. So, if prenatal listening is already associated with mentioned

⁸⁵ Ibidem.

⁸⁶ Ibidem.

organized oral movements, it's likely to presume that newborns could later use sucking behaviors as a means of interacting with the sound and responding to it.⁸⁷

This connection between early oral motor behavior and auditory experience leads us to the classic experiment by DeCasper and Fifer, in which newborns only a few days old were placed in a situation where they could control which voice they heard, either their mother's or another woman's, by modifying their sucking patterns on a non-nutritive nipple. Over the session's course, infants increasingly adjusted their sucking in a way that made their mother's voice more likely to play, showing that they could both distinguish between different voices and that they preferred the one they previously learned. This preference, however, did not appear immediately. It developed across testing sessions, which indicates that the infants were discovering and exploring their connections between their actions and the auditory feedback, which demonstrates how capable newborns are of quick auditory learning and goal-directed control of the world around them.⁸⁸

Although newborns have had very limited postnatal exposure to their mothers, the strong preference for her voice, that they discriminate based on their sensitivity of acoustic features of speech, suggests that the auditory system has been shaped by the prenatal experience. When the fetus repeatedly hears their mother's voice filtered through the womb, they are naturally sensitive to its rhythm, its intonation and the variation of frequency. Taken together, these findings showcase that the reason that newborns are

⁸⁷ Ibidem.

⁸⁸ Anthony J. DeCasper, William P. Fifer, *Of human bonding: Newborns prefer their mothers' voices*, in "Science", 208 (1980), pp. 1174–1176.

attracted to their mother's voice reflects not only their bonding after birth, but also the learning that came before birth with prenatal auditory exposure.⁸⁹

This early sensitivity to sound and voice provides a powerful foundation for language acquisition, which together with linguistic development is the key aspect of child development. The sensitivity that develops before birth, as shown, does not disappear after the child is born, but instead becomes reorganized into patterns of interactions between the mother and her infant. We already discussed how from the first days of life, infants are not passive, but active participants in exchanges with their mothers. More research on the earliest mother-infant interactions has shown that mothers continuously adapt their actions to their infants' rhythms, creating predictable turn-taking long before language itself emerges. These early exchanges are described as coordinated systems, in which maternal behavior fits and tunes itself to the activity of the infant, transforming behaviors that are biologically driven into routines. Newborn behavior is organized in cycles of activity and pause; a good example is feeding during which infants suck in short bursts separated by regular pause, a pattern biologically given and stable across infants.⁹⁰

What is not biologically given is the mother's response to these rhythms, they adapt their movement and touch to the timing of these pauses often intervening just after a pause rather than during a burst. Mothers shape the flow of interactions in a way that feels immediate, even for mothers who are mothers for the first time, suggesting that maternal behavior is very finely tuned into the biological organization the infant already has. This tuning is not static either, it is increasingly coordinated with the infant's activity as they

⁸⁹ Ibidem.

⁹⁰ Kenneth Kaye, *The Mental and Social Life of Babies: How Parents Create Persons*, University of Chicago Press, Chicago 1982.

grow, maternal interventions become more precise and more coordinated, allowing for adjustment. A similar pattern was observed in early face to face encounters too, since in the first weeks of life the facial expressions of the infant are random and not yet linked to mother's behavior. However, over the following months these expressions begin to "cluster" and form sequences that resemble turn-taking.⁹¹

By the age of six months, infants not only respond to their mother's expressions, but also initiate these exchanges themselves. An explanation of this could be that the mother continuously structures the interaction in a way that makes this coordination even possible, but we must keep in mind that there are individual differences to be considered. Mothers vary in how quickly they intervene during feeding pauses, how often they elicit infant responses during face-to-face play, and how effective they are at it, how much they guided the attention of their infants during tasks etc. These maternal styles mentioned persist even as the infant behavior changes rapidly, so we can conclude that continuity in these early interactions lie primarily on the caregiver and not so much as the mother-infant dyad as a unit. Importantly, when researchers controlled for others socioeconomic factors, such as maternal education, the stability of the mother-infant interactions weakened, however mother's own pattern of behaviour remained consistent.⁹²

These findings do not diminish the infant's role as an active and responsive part of the dyad, but highlight a very important asymmetry. A truly formed and shared system that we usually have in mind when talking about the mother-infant relationship is not present from the beginning per se, but develops more and more over time, as the exchanges

⁹¹ Ibidem.

⁹² Ibidem.

become more mutual and more organized. From this perspective, early maternal input functions not as half of one fully formed system, but as support for the infant that enables it to learn how to participate in exchanges with others and with society. Before a child can successfully integrate itself in society, it is essential that they master the language of the community and develop the basic communication skills in order to share their needs, share their opinions, interact with others and academically flourish in life stages that are yet to come.⁹³

During the earliest childhood days, the child is, in most cases, accompanied and cared for by its mother as a primary caregiver. The mother of the child plays a prominent role in her child's life, and her maternal input further shapes the child's linguistic abilities. Therefore, to get an even better understanding of the importance of early maternal input, we must thoroughly understand what it is.

Maternal input refers to the communication provided by mother, either verbal (talking to the child) or non-verbal (interactive play session), that encompasses aspects such as the quantity and quality of language, grammatical complexity and maternal responsiveness. This indicates that the quality of the interactions mother initiates and maintains with the child, as well as the diversity of words and grammatical structures she uses, is crucial for the developmental trajectory of the child.⁹⁴

Early research on mother's speech emerged in the late 1960's as a part of a broader challenge to the idea that language develops independent of the environment. Many

⁹³ Ibidem.

⁹⁴ Nan Xu Rattanasone, Ruth Brookman, Marina Kalashnikova, Kerry-Ann Grant, Denis Burnham, Katherine Demuth, *Maternal Input, not Transient Elevated Depression and Anxiety Symptoms, Predicts 2-year-olds' Vocabulary Development*, in "Journal of Child Language" (2024), pp. 1–12.

different studies joined with perspectives mentioned earlier helped shift attention away from viewing language as something that unfolds rather automatically and toward understanding acquisition as a process shaped by interaction. Rather than treating mother's speech as background noise, new work has revealed that mother's input is accurate in reflecting deeper assumptions about how children learn and think. The connection of caregiver speech to not only language development, but also cognitive and emotional growth, was getting increasingly more recognition. Soon learning to talk became less of a matter of absorbing words and grammar and more of participating in exchanges with another person.⁹⁵

From the earliest months of life, both the child and its caregiver contribute to these meaningful exchanges, each shaping the direction of the exchange itself. To put differently, children play an active role in shaping the input they receive. Mothers do not consistently use child-directed speech unless the child is present and responsive. Even experienced caregivers rely on cues that guide how they speak. The belief of the mother about the abilities of her child further influences how they talk, for example, when the mother thinks her child is capable of understanding, they tend to use richer speech. In this way, infants are not just passive recipients of language, but participants who help structure the input they are learning from. Differences in cultural expectations and social background also affect how caregivers interpret the behavior of the child and how they

⁹⁵ Catherine E. Snow, *Mother's Speech Research: From Input to Interaction*, in C. E. Snow, C. A. Ferguson (eds.), *Talking to Children: Language Input and Acquisition*, Cambridge University Press, Cambridge 1977.

speak to them, further showing that language development unfolds within a social and interactive contexts.⁹⁶

To get a better understanding of how culture influences parenting, let's have a look at how it is defined. According to Bornstein, culture is “usefully conceived of as the set of distinctive patterns of beliefs and behaviors that are shared by a group of people and that serve to regulate their daily living.”⁹⁷

Every culture is shaped by embedded ideas on how people should think and behave, and these ideas further extend into the ways parents raise their children. As a result, parenting becomes a system shaped by values and social expectations, transmitted across generations and practiced through everyday caregiving routines. Cultural models already present shape how parents interpret their role, how they interact with children and what they teach them, what behavior they encourage and which behavioral and developmental outcomes they consider desirable. Research comparing different cultural settings further highlights these differences. For example, a culture that prioritizes individuality and autonomy will tend to encourage children's independence, whether through indirect guidance or verbal suggestions. In contrast, cultures that support interdependence will tend to rely more on direct guidance and explicit instructions.⁹⁸

An example for this could be a study that explored how cultural values shape maternal behaviour by examining interactions between mothers and their infants in everyday contexts in Anglo American and Puerto Rican families. Focusing on infants aged 12

⁹⁶ Ibidem.

⁹⁷ Marc H. Bornstein, *Cultural Approaches to Parenting*, in “Parenting: Science and Practice”, 12 (2012), p. 212

⁹⁸ Ivi, pp. 212-221

months to 15 months, the researchers investigated whether long-term socialization goals of the mothers were reflected in the ways they interacted with their infants in different situations. Mothers were first interviewed about the qualities they hoped their children would develop as adults, and those that they hoped they wouldn't, which represented the mentioned long-term socialization goals. The interviews already highlighted clear cultural differences, as Anglo-American mothers emphasized values associated with independence and personal choice, leaning toward individualistic agency and approach. On the other hand, Puerto Rican mothers expressed goals related to connectedness more often, leaning towards a sociocentric cultural framework. The important thing to note here is that these beliefs did not only represent abstract ideas for these mothers, but appeared to guide their parenting strategies. To examine how they applied these values in practice, they were videotaped interacting with their infants in common daily routines that included feeding, social play, teaching, and free play. Puerto Rican mothers were more likely to directly structure their infant's behaviour through commands and body involvement, while Anglo mothers allowed their children a higher level of autonomy.⁹⁹

This coherence between their belief system and practices they used suggests that maternal input and maternal behavior are culturally organized, not random in different situations. Although mothers did adjust their behaviors depending on the context they found themselves in, the underlying cultural orientation remained quite stable, for example in teaching contexts mothers maintained interaction styles that showed their beliefs about how children learn and how parents should guide them. In addition to maternal behavior,

⁹⁹ Robin L. Harwood, Axel Schoelmerich, Pamela A. Schulze, Zenaida Gonzalez, *Cultural Differences in Maternal Beliefs and Behaviors: A Study of Middle-class Anglo and Puerto Rican Mother–infant Pairs in Four Everyday Situations*, in “Child Development”, 70 (1999), pp. 1005–1016.

infant responses were also observed to further ensure that the differences in maternal behavior that emerged weren't only due to differences in infant's temperaments and gender effects were also measured and found to be insignificant. Situation-specific analysis showed that during feeding Anglo mothers were more likely to encourage self-feeding, while Puerto Rican mothers preferred directly feeding their infants. During social play, Puerto Rican mothers engaged more in touch-based games reflecting a more physically interactive style, in alignment with these results, more affection was also displayed during teaching. All of these findings together suggest that there is a level of flexibility mothers demonstrate based on the situation they're in, but it consistently reflects their cultural goals and beliefs.¹⁰⁰

Further cross-cultural research reported by Bornstein proves this point that maternal input is shaped but untold "rules" of what parents feel they must do and what their culture values the most, an illustrative example being an observational study by Bornstein who examined natural interactions between mothers and their infants in five different cultural contexts: Argentina, Belgium, Israel, Italy, and the United States. By observing mother-infant dyads in their own homes, this study captured caregiving in a natural environment similar to the study already mentioned, including language, social engagement, physical care, and teaching behaviors. All of these countries are different from each other in their history, their language and their values, but similarity in socioeconomic conditions made it possible to identify cultural differences on maternal behavior and input specifically.¹⁰¹

¹⁰⁰ Ibidem.

¹⁰¹ M. H. Bornstein, Y. Park, O. M. Haynes, J. T. D. Suwalsky, H. Azuma, S. Bali, E. Berti, A. De Houwer, C. de Zingman Galperin, M. Kabiru, K. Kwak, M. Maital, M. L. de Moura de Seidel, A. B. Nsamenang, M.-G. Pêcheux, J. Ruel, S. Toda, P. Venuti, A. Vyt, *Infancy and Parenting in 11 Cultures: Argentina, Belgium, Brazil, Cameroon, France, Israel, Italy, Japan, Kenya, South Korea, and the United*

Results showed that maternal input varied not just in quantity, but also quality, as mothers differed in how often and how intensely they engaged in different areas, yet no cultural group consistently showed a higher interaction across all areas. Alongside these differences mentioned, mothers and their infants across all culture groups showed a strong degree of coordination. More specifically, infants showed more advanced behaviour in the same domains that their mothers invested in more.¹⁰²

To conclude, while some aspects of caregiving are universal, such as nurturing and protection of their infant, others are shaped by cultural beliefs and language provides an example of the ongoing question between universality and variation. Although we discussed how capacity for language learning may be biologically grounded, the communicative environment in which infants grow is culturally organized, since language is shaped by the social contexts in which it is used and isn't used in a vacuum. Other than the culture and the setting in which conversations take place, communication is always embedded in context, from which it cannot be separated. Furthermore, it is shaped by many interacting factors, such as who and to whom they are speaking, for what purpose, about what topic etc. Speakers adjust their language depending on these situational elements and in this way create different communicative styles, often referred to as registers, that tend to be consistent with a given situation and appropriate to a specific context. This sociolinguistic framework is an interesting lens through which we can view caregiver-infant communications, in which maternal language could be shaped based on the goals the mother intends of the interactions, such as soothing vs. instruction.

States, Unpublished Manuscript, Eunice Kennedy Shriver National Institute of Child Health and Human Development, 2012.

¹⁰² Ibidem.

As a result, children are exposed from their earliest life stages to situation-specific forms of language and communication, that reflect context, intent, goals and cultural norms.¹⁰³

Language is shaped with the intention of it being spoken to the developing child, therefore a socially and culturally organized form of maternal input may appear to guide attention, express affection or emotion and support comprehension. In other words, the register that emerges we can simply call “child-directed speech”.

¹⁰³ Alvino E. Fantini, *Language Acquisition of a Bilingual Child: A Sociolinguistic Perspective*, Multilingual Matters, Clevedon 1985.

2.2. Child-directed speech and Parental Adaptation in Speech to Children

As shown in the previous subchapter, the characteristics of language input are shaped based on the intended listener. We choose the topics, our tone and the complexity of our speech according to our own intention, but also the competence of our speaking partner. Naturally, language directed to a child differs systematically from language directed to an adult and carries enhanced simplicity and redundancy.

This modified register, which will be referred to as “child-directed speech” in the following pages, reflects the adaptation of language to the child’s abilities, rather than just a simplified form of adult speech. This connects to a larger theoretical debate about how much linguistic input is necessary for a child’s language development. Chomsky approached this debate from what he called the “argument from poverty of the stimulus” and suggested that the information available to children in their environment is not enough, on its own, to explain the complex grammatical knowledge they eventually acquire.¹⁰⁴

Chomsky’s discussion is positioned within older philosophical arguments, such as Descartes’ and Kant’s and his “argument from poverty of the stimulus” could be considered as a modern modified version of their earlier claims. He drew on Descartes’ reflections on perception and emphasized that sensory input does not resemble those mental representations that arise from it, in this way suggesting that the mind must contribute its own principles in order to interpret experience. This line of reasoning was

¹⁰⁴ Noam Chomsky, *Rules and Representations*, Columbia University Press, New York 1980.

also developed by Kant, who proposed that perception is shaped by the cognitive structures through which the world is understood, so it doesn't serve just as a "copy" of external reality. The review of these positions lies in Chomsky's argument that the linguistic stimulus available to the child doesn't contain the needed abstract properties that mark grammatical knowledge, so the child could not derive grammatical principles directly from exposure. Instead, the child uses the limited input as a base and then constructs the interpretation under the guidance of its internal constraints. From his viewpoint, this is how children move from the information available in the stimulus itself, since their cognitive system already includes inherent ways of representing experience and organizing experience.¹⁰⁵

Chomsky's position allows for the role of environmental input while emphasizing that the fundamental base of language acquisition lies in biologically grounded characteristics of human minds and cognition. Applying this perspective to caregiver speech, said speech may support comprehension and interaction, yet the emergence of linguistic structure still depends on internal capacities of the learner.¹⁰⁶

However, acknowledging the importance of internal capacities does not remove the need to consider the nature of input itself. An alternative way to look at speech addressed to children is to consider that it may not be as limited or even degraded as once assumed, but instead adapted specifically to developing linguistic abilities. The idea that children learn language from poorly structured input and degraded forms of speech adults use with each other could be challenged with the opposing idea that speech is finely tuned and

¹⁰⁵ Ibidem.

¹⁰⁶ Ibidem.

adapted to children's psycholinguistic capacity. This type of speech doesn't occur only with infants; an example would be the case of Genie, a child who was completely deprived of all linguistic interaction until adolescence.¹⁰⁷

Genie faced years of extreme isolation and was exposed to language for the first time at nearly fourteen years of age. As Genie began to acquire language, her development followed the progression through well-known stages, with her comprehension preceding production and her early utterances resembling those of younger children. She began to imitate words used by adults within weeks of her admission, and her comprehension of individual words increased rapidly before she was even able to produce them spontaneously. Over time, her speech expanded from isolated words to two-word combinations to longer strings of words that showed increasingly more complex syntactic relations, for example subject-verb-object structures or modified noun phrases. Genie's ability to express herself lagged behind her comprehension of others, indicating that adults continued to communicate to her in ways that supported comprehension rather than grammatical mastery, which is also a central quality of child-directed speech.¹⁰⁸

Further evidence from this case has shown that adults instinctively changed their speech when trying to communicate with her by producing a style of language that is slow and repetitive, but more articulated than baby talk, typically used with much younger children. These findings further suggest that child-directed speech is not tied to age alone and can be seen as a strategy for making communication possible. Importantly, Genie appeared

¹⁰⁷ Victoria Fromkin, Stephen Krashen, Susan Curtiss, David Rigler, Marilyn Rigler, *The Development of Language in Genie: A Case of Language Acquisition Beyond the "Critical Period"*, in "Brain and Language", 1 (1974), pp. 81–107.

¹⁰⁸ Ibidem.

to give her attention selectively to speech that was directed towards her, while mainly ignoring other adult to adult conversations. The alteration in rate of speech and sentence structures was not a result of direct instructions or even a planned intervention but happened naturally as adults attempted to be understood by a linguistically underdeveloped listener. Her progress was limited and slow, however the form of input she received played a central role in the way she acquired language. Genie's case illustrates that child-directed speech is not a sole feature of caregiving, but a human response to communicative vulnerability, which helps us defend the view that language input is shaped by social interaction and our sensitivity to the needs of the listener.¹⁰⁹

This observation raises a broader question that is if the speech is naturally adjusted as a response to the communicative capacities of the child, how systematic is this adaptation and to what extent is it tied to each individual child's linguistic development? Research on maternal input has approached this question from various perspectives.

The first perspective is presented by Chomsky, often referred to as the indifferent hypotheses, input functions as a "trigger" that allows the child to activate a linguistic capacity that already exists, since child-directed speech in his view is not rich enough or consistent enough to teach grammar. Through the lenses of his theories, the variations in adult speech, such as the slowed and simplified patterns observed in the case of Genie, are not seen as central in acquisition, but seen as cues that stimulated the underlying structures and capacities she already had. This connects to his main idea that language is

¹⁰⁹ Roger Brown, *Introduction*, in C. E. Snow, C. A. Ferguson (eds.), *Talking to Children: Language Input and Acquisition*, Cambridge University Press, Cambridge 1977.

guided through innate principles and the environment provides conditions under which these innate structures emerge.¹¹⁰

One step further is the multifactor hypothesis, proposed by Newport. It argues that maternal speech is shaped by multiple interacting factors at the same time. Instead of it serving as a simple environmental trigger for language acquisition, it serves as a structured tool that takes into account the speakers' communicative goals, the structure of the conversation that is being held, the child's cognitive abilities, and then combines them in a non-uniform way. The non-uniformity stems from the idea that some features of speech are finely adjusted to the child's linguistic competence, for example sentence length, while others are adjusted to non-linguistic factors, such as the child's attention or age.¹¹¹

According to this view, simplification is not always used for making grammar easier to learn, but also serves to maintain the conversation flowing, manage turn-taking, or even to keep the child engaged and aware that it is being spoken to, such as in the Genie case where she ignored adult-to-adult speech. So, as a result, the linguistic environment can be viewed as structured, but also not optimized for syntax alone.¹¹²

Newport's later research expansion further emphasized that the influence of caregiver speech must be understood in the context of the learner, since children actively select what information they will use from their environment, when they will use it and how will they incorporate it into their linguistic system; so from this perspective child-directed

¹¹⁰ Chomsky, *Aspects of the Theory of Syntax*, op.cit.

¹¹¹ Elissa L. Newport, *Motherese: The Speech of Mothers to Young Children*, in N. J. Castellan Jr., D. B. Pisoni, G. R. Potts (eds.), *Cognitive Theory*, vol. 2, Lawrence Erlbaum Associates, Hillsdale (NJ) 1976, pp. 180–203.

¹¹² *Ibidem*.

speech may facilitate attention and perception, but the interpretation of the input they receive will depend on internal predispositions that allow for the emergence of grammatical structure.¹¹³

The above mentioned perspective shares several central similarities with Chomsky's framework, while differing in explanatory focus. Both approaches reject the idea of language acquisition being explained only through environmental input and child's exposure to it. Chomsky's argument that the linguistic data the child receives contains insufficient information and therefore the mind contributes intrinsic organization and principles to account for the complexity of grammar knowledge was already discussed, from which we can see that his aim primarily was to explain the nature of linguistic knowledge and biological foundation that makes learning a language possible. The perspectives that focus primarily on caregiver-child communication and motherese, highlight and examine how variations in the child's linguistic environment relate to developmental outcomes, allowing this perspective to put questions of interactions with caregivers and contextual adaptation as more central, a topic that was more outside of Chomsky's theoretical discussions.¹¹⁴

Another difference concerns mainly the level of strengths of the innate structure claims. Chomsky proposes that development of language reflects a rich internal organization, grounded in biology and with experience acting mainly as a trigger for these already internally guided processes. Newport acknowledges internal biases as well, but places greater emphasis on the dynamic child-environment relationship and explains more how

¹¹³ Lila R. Gleitman, Elissa L. Newport, *The Current Status of the Motherese Hypothesis*, in "Journal of Child Language", 11 (1984), pp. 43–79.

¹¹⁴ Newport, *Motherese*; Chomsky, *Rules and Representations*, op.cit.

maternal language adjusts to the learner through child-directed speech. Nonetheless, both positions attribute a central role to the characteristics of the learner and learner's internal constraints, rather than treating language acquisition as an associative or as an imitative process. Together, even after taking into account their differences, these perspectives are not contradictory to one another, but can be seen as complementary.¹¹⁵

Moving from these theoretical perspectives back to answering the question of how maternal speech varies in relation to each child's individual competence, Cross's study examines if and how systematic mother's adjustments of speech were. Using recordings of interactions happening between mother and child dyads, multiple dimensions of maternal speech were analyzed, including syntactic complexity, repetition and referential clarity, while taking into account measures of children's development for example their age, comprehension and mean length of utterance.¹¹⁶

The results showed that the mother's speech was closely aligned with the child's linguistic and communicative abilities, rather than age alone, which was a point proven in the Genie's case also, when adults used simplified speech similar to the one usually used with very young children. Across more than sixty different parameters of mother's speech, maternal discourse adjustments were associated the most with measures of the child's receptive control and ability to comprehend, while syntactic features, including utterance length and complexity, increased as children's maturity in the linguistic aspect grow. In fact, receptive ability was the most consistent predictor of how children shaped their

¹¹⁵ Ibidem.

¹¹⁶ T. G. Cross, *Mother's speech adjustments: The Contributions of Selected Child Listener Variables*, in C. E. Snow, C. A. Ferguson (eds.), *Talking to Children: Language Input and Acquisition*, Cambridge University Press, Cambridge 1977.

speech into child-directed speech, when children demonstrated weaker comprehension, mothers in return made more expansions, repetitions, as well as elaborations. Referential language also shifted, with mothers using references to immediate contexts less and talking about non-present events more. The patterns showed in this evidence fit the hypothesis where input is shaped by sensitivity to the listener's current linguistic abilities, while also supporting the multifactorial view with different aspects of speech responding to different child variables.¹¹⁷

A contrasting hypothesis comes from Jerome Bruner, a social interactionist who proposed ideas from which some served as an inspiration to Tomasello, previously discussed in Chapter 1. Bruner's admits that of Chomsky's view and proposal of a "Language Acquisition Device" presents a very important point in history that moved the discussion from behaviourist explanations of language learning, nativist views offered an alternative that stopped treating language as a form of conditioned behaviour and remained influential. However, Bruner's opinion is that focusing on an internal mechanism to this degree leaves out something very essential, which is the role of interaction of experiences the child encounters. "Language Acquisition Device" highlights innateness and internal "readiness" to interpret limited input, Bruner's framework shifts attention to processes that link cognition, communication, and experience, so, it's not just biology that explains language, interaction does.¹¹⁸

Bruner formulated his own concept called the "Language Acquisition Support System" in which he places the development of language in the context of everyday exchanges

¹¹⁷ Ibidem.

¹¹⁸ Jerome Bruner, *Child's Talk: Learning to Use Language*, Norton, New York 1983.

that happen between caregivers and children, moving the primary explanatory mechanisms from solely inside the child to the interaction with environment and caregivers. He gave examples of interactional routines such as routine activities, games, shared attention to objects, and argued that these routines create contexts in which communication becomes predictable, and therefore manageable for the learner. The fact that these interactions are organized around recognizable patterns, the adult can highlight some aspects of language and meaning in a way that would match the child's level of comprehension in said moment, which is also an important purpose of child-directed speech.¹¹⁹

The concept of “formats” in Bruner's work is introduced to bring all of the mentioned organized interactions and exchanges under one concept. The interactions are presented as sequences and governed by rules in which both the caregiver and the child depend on one another, so each response is shaped by what the other communicative partner has just done. Moreover, the mother-child relationship and the interactions they share are not a background condition in his theory and his discussion provides concepts which we can apply to have a better understanding of child-directed speech. Maternal speech adjustments seen in child-directed speech, such as repetition and simplification, can in his view be interpreted as a part of a system that offers support and facilitates the child's transition from early communicative behavior to complex language use. Within a format, adult's speech is shaped and formed naturally by the need to maintain the child's engagement. Repetition, exaggerated forms and intonation, constructions that are simplified and phrases that are predictable, all support the shared goal of the interaction.

¹¹⁹ Ibidem.

Because formats involve scenarios that repeat over time with recognizable roles and outcomes, they provide a context that feels stable for the child in which expressions can be linked to meaning.¹²⁰

A comprehensive understanding can be obtained when these perspectives are considered together. Chomsky's important proposal of an innate linguistic system sheds light on the importance of internal constraints that make language learning possible. After all, if there were truly no prior capacities, input alone could not shape language. Considering Bruner's interactionist views, we can understand the emergence of language also through interactions in which caregivers organize participation and provide support through predictable routines. Newport's work gives contributions in demonstrating that characteristics of the learner together with properties of the linguistic input shape acquisition. Children may therefore be considered as biologically prepared learners who possess innate capacities to acquire language, but whose abilities develop through interaction through a communicative environment. Their communicative environment is actively shaped by their caregivers, who use structured input, such as child-directed speech, to provide support for the emerging linguistic knowledge.

Moving from the theoretical debate to more empirical evidence, Snow's work offers more detail on caregivers adjusting what they choose to express when speaking to a child, her work demonstrating that syntactic simplicity of maternal speech corresponds closely to its semantic simplicity. In other words, since the structure of the sentence itself is simple, the meaning of what is said is simple and, hence, limited. This also supports the evidence

¹²⁰ Jerome Bruner, *The Role of Interaction Formats in Language Acquisition*, in J. P. Forgas (ed.), *Language and Social Situations*, Springer, New York 1985.

from the Cross study which showed mothers aligning linguistic forms with the child's current level of understanding. The maternal choice of simplicity does not occur randomly, but is rather strategically used so the simplicity of the grammar structures aligns with the limited meanings and ideas they are expressing. Moreover, the research indicates that the maternal input is not only shaped by not only the child's cognitive level, but also by the social context of early language use. Mother's discuss immediate and easily observable events, supported by present tense verbs and concrete nouns, often reinforced with hand gestures that create a rich linguistic environment which is comprehensible for the child and, therefore, facilitates its language acquisition.¹²¹

After establishing that the efficacy of child-directed speech goes beyond sole simplicity, it is apparent that speech directed to infants is quite noticeably different from adult conversations, in both sound and structure. Infants are surrounded by a large amount of auditory signals, but they seem to not respond to all speech the same way. Modifications of speech appear to create such a signal that appears easier for very young listeners to primarily hear and later interpret. Evidence from experimental research suggests that even newborns and infants in their earliest life stages show higher interest in infant-directed speech compared to adult-directed speech, with infants maintaining their gaze for longer periods of time when they were presented with an auditory stimulus that consisted of infant-directed speech than to the stimulus that consisted of adult-directed speech. This preference appeared very early, with comparison between a group of newborns and slightly older infants both showing a very comparable preference and suggesting that this

¹²¹ Catherine E. Snow, *The Development of Conversation Between Mothers and Babies*, in "Journal of Child Language", 4 (1977), pp. 1–22.

effect does not arise from learning in the first months of life. What might be an explanation is that there are capacities for this already present at birth.¹²²

Another quite interesting body of evidence comes from a study that tested if the infants' preference of child-directed speech was restricted to their native language. In a study including both English-learning and Cantonese-learning infants at 4 and a half and 9 months of age, infants showed attentional and affective preference for infant-directed speech stimulus presented in Cantonese, regardless of the fact if it was their native language. The stimuli used was an audio-visual recording of a woman speaking Cantonese in two kinds of interactions: one with an infant and one with an adult. The responses of infants were measured and evaluated across the dimension of attention, by considering the time spent looking at the stimulus, and the dimension of affective engagement, by assessing and rating the infants' attempts to interact and their overall emotional state.¹²³

Children tended to look significantly longer and displayed more overall positive affect during infant-directed communication, a pattern that remained stable regardless of language background or age group. These findings bring to light a meaningful property of child-directed speech, which is that it captures and holds the children's attention in a broad sense, seemingly without the limits of being familiar to a particular language.¹²⁴

¹²² Robin Panneton Cooper, Richard N. Aslin, *Preference for Infant-directed Speech in the First Month After Birth*, in "Child Development", 61 (1990), pp. 1584–1595.

¹²³ Janet F. Werker, Judith E. Pegg, Peter J. McLeod, *A Cross-Language Investigation of Infant Preference for Infant-Directed Communication*, in "Infant Behavior and Development", 17 (1994), pp. 323–333.

¹²⁴ *Ibidem*.

Children tend to react to speech directed towards them and pay less attention to speech happening between two adults, but what are those speech elements that child-directed speech has that captures their attention? The following research by Fernald and Kuhl presents how unique acoustic features attract and hold the focus of the infant. Using synthesized speech, Fernald and Kuhl demonstrated that infants are drawn to speech that features exaggerated pitch contours typical to the language a mother uses with her child, confirming that this melodic aspect is the primary acoustic element that captures the interest of the child. Lexical use of parental speech is another quality that infants pay attention to, since special words related to affection are especially pleasant to the child. However, in this particular study, the author deemed it necessary to abolish the lexical matter from motherese speech in order to test the hypothesis that the intonation of the motherese speech alone is adequate to elicit the preference of the infant for mother's voice. The hypothesis was tested through three different experiments and each of them was designed to demonstrate a preference, or the lack of a preference, for a different sound component.¹²⁵

In Experiment number one, the purpose was to discover whether the infants orientate in the direction of the stimuli attained from their mother's speech and how this behavior differs. Measuring the head-turn reaction of the infant, the authors aimed to evaluate identification and preference for maternal speech, as well as the ability of the infant itself to turn their head in order to begin the reproduction of the auditory stimuli. The results of this experiment showcase the preference of the higher and more varied sounds that had

¹²⁵ Anne Fernald, Patricia K. Kuhl, *Acoustic Determinants of Infant Preference for Motherese Speech*, in "Infant Behavior and Development", 10 (1987), pp. 279–293.

the pitch patterns of motherese, considering the fact that the infants turned their head more often towards this category of sounds versus the sounds based on normal adult speech. Since the researchers discarded the other qualities, such as lexical content or volume changes, the only remaining quality that could lead to this choice was the pitch.¹²⁶

In Experiment number two, however, the pitch was no longer a varying factor, but rather a controlled constant across each of the stimulus pairs calculated as the average of the infant-directed speech and adult-directed speech of each talker. This experiment was focused on amplitude modulation, or in other words, how the loudness of speech increases and decreases over time. The experimental design itself, including the procedures and the apparatus used, was identical to the one used in the first experiment. However, unlike the first experiment, this one did not reveal evidence of a significant infant preference for the amplitude-based and duration-based characteristics of speech, further suggesting that these characteristics alone are not enough to induce a listening preference.¹²⁷

On the contrary of the first two experiments, in which the duration of the stimuli was mixed with frequency (pitch) and amplitude (loudness), in Experiment number three the duration itself was isolated as a variable of interest. This means that the stimuli were based only on the timing patterns of infant-directed speech and adult directed speech, with the pitch and the loudness staying constant. As expected, considering the findings of the second experiment, in the third experiment infants did not demonstrate a reliable preference for the duration patterns of infant-directed speech, which further highlights

¹²⁶ Ibidem.

¹²⁷ Ibidem.

that these patterns, when isolated from pitch and amplitude cues, are not enough to bring out a listening preference.¹²⁸

However, the authors highlight the need for caution when interpreting these results, since the stimuli samples used did not include the often exaggerated rhythmic patterns that can occur when playing games with infants, hence this can limit how representative the stimuli were. Across experiments, infants only showed a significant preference for the F0 pitch patterns of infant-directed speech which suggests that the dynamic pitch modulation is the most notable acoustic cue in motherese, acting as signal that captures the attention of the infants.¹²⁹

It is important to note, however, that in everyday interactions, pitch is not isolated, and it interacts with amplitude, rhythm and visual cues. Visual cues can include facial expressions and hand gestures, which additionally engages the child to interact. All of these combined signals probably make motherese even more engaging and help infants interact and learn. Given the points already made on lexical matters and sound patterns, a natural next step would be to consider how infants use the visual cues presented to them in interactions and how these cues that carry linguistic, social and even emotional information can help the comprehension of the infant, especially in times when the auditory signal is unclear to them.

Birulés and colleagues demonstrate that infants actively explore the visual dimension of caregiver speech and tend to look longer at the mouth of the speaker during their first and second year of life, which helps them detect different speech sounds and learn linguistic

¹²⁸ Ibidem.

¹²⁹ Ibidem.

patterns. During interactions, infants systematically shift the attention towards the mouth of the speaker, particularly in those developmental stages in which phonetic learning and rhythmic learning are the most demanding. This visual focus helps infants to integrate auditory input with articulatory cues, reducing ambiguity, which then supports their speech processing. These findings highlight how child-directed speech unfolds through speech, but also through facial movement and gaze.¹³⁰

This is especially important for bilingual children, which may look at the mouth of the person speaking even longer than monolingual. Bilingual children need to learn differentiating between two linguistic systems. These systems often share similar or overlapping phonological and rhythmical characteristics, which can make early language processing even more complex. In one study, monolingual and bilingual infants growing up were shown audiovisual recordings of a speaker while their gaze towards the eyes and the mouth was measured across their first year. Both groups did indeed show differences and changes in attention, however monolingual infants initially focused more on the eyes, later shifting their attention to the mouth area, whereas bilingual infants showed an earlier attention to the mouth. This pattern was studied and interpreted as reflecting the adaptive response to the demands of a dual language environment.¹³¹

Bilingual infants encounter a challenge of identifying and then maintaining the separation between two linguistic systems, so visual cues from the mouth provide redundant information that supports the recognition of features that are language-specific. Increased

¹³⁰ Joan Birulés, Louise Goupil, Jérémie Josse, Mathilde Fort, *The Role of Talking Faces in Infant Language Learning: Mind the Gap Between Screen-based Settings and Real-life Communicative Interactions*, in “Brain Sciences”, 13 (2023), 1167.

¹³¹ David G. Lewkowicz, Núria Pons, Laura Bosch, *Bilingualism Modulates Infants’ Selective Attention to the Mouth of a Talking Face*, in “Psychological Science”, 26 (2015), pp. 490–498.

attention to the mouth area could be understood as a strategy that has developed in an answer to the greater complexity of bilingual input.¹³²

These findings supports further the idea that infants are active learners who adapt their attention based on the demands of the environment. By relying on auditory and visual cues, infants are able to shape their learning strategies to match the conditions in which the language is being presented to them, which is especially important when the linguistic environment itself is more complex and offers more than one system to be learned. On that note, while all infants must learn to interpret cues from their environments, bilingual children do so in a setting where multiple linguistic systems are active at the same time. This makes bilingual development an interesting and rich context for language learning, which the following subchapter will turn to in order to explore it with greater depth.

¹³² Ibidem.

2.3. The Bilingual Mind in Childhood

Building on the idea from the previous pages that infants actively recruit cues from their environment to support their language learning, bilingual development can be understood as a particularly rich case of these adaptive processes. From the very beginning, children who grow up with two languages are just exposed to more linguistic material, but also to a communicative environment in which multiple systems coexist and interact. Even very young bilingual children demonstrate awareness of this dual system, sometimes even explicitly identifying themselves as bilingual children when they are older, which suggests that managing two languages is not just a matter of passive exposure to both of them, but also of active cognitive organization.¹³³

In these early years, the two languages are already differentiated, yet they remain in constant contact with the development of the linguistic systems of the child. This allows the patterns from one language to shape the use of the other and the interaction is visible in shifts in word order and in the frequency with which certain structures are used, especially in those cases where similar constructions exist across the two languages. Rather than this presenting itself as a sign of confusion, this influence reflects a learning strategy in which children rely on structures that are shared and forms that seem unclear in their environment in order to organize their growing grammatical systems. Mechanisms such as code-switching, code-alteration and the negotiation between grammar options are important to mention and understand on a deeper level, since they

¹³³ Virginia Yip, Stephen Matthews, *The Bilingual Child: Early Development and Language Contact*, Cambridge University Press, Cambridge 2007.

show us how bilingual children navigate their linguistic environment and select or reshape forms of both languages they speak.¹³⁴

Code-switching refers to “the mixing, by bilinguals (or multilinguals) of two or more languages in a discourse, often with no change of interlocutor or topic”.¹³⁵

In other words, a strategy in which the speaker moves between the two languages in a single interaction by selecting forms from whichever system they feel fits the communicative situation they are in the best. This is not random but rather shows that both of the languages remain available and functional while they allow the child to assess and select.¹³⁶

Code-alteration is defined as “a relationship of contiguous juxtaposition of semiotic systems, such that the appropriate recipients of the resulting complex sign are in a position to interpret the juxtaposition as such”.¹³⁷

In bilingual interactions, the movement between languages is not just about switching codes from one to another, but also in organizing the meaning within conversation. Rather than treating bilingual speech as a mix of two separate grammars, this approach gives importance to how the speaker uses the language as a resource that shapes the flow of the conversation itself. For example, when a speaker alternates between languages, the alteration itself becomes the part of the message, since it can signal a change of topic, highlight a contrast or it can also frame how they intend their speech to be understood.

¹³⁴ Ibidem.

¹³⁵ Shana Poplack, *Code Switching: Linguistic*, in “International Encyclopedia of the Social & Behavioral Sciences”, 2001, p. 2062.

¹³⁶ Ivi, pp. 2062-2065.

¹³⁷ Peter Auer, *The Pragmatics of Code-switching: A sequential approach*, in Lesley Milroy, Pieter Muysken (eds.), *One Speaker, Two Languages: Cross-Disciplinary Perspectives on Code-Switching*, Cambridge University Press, Cambridge 1995, p. 116.

Similar as in the case of code switching, these shifts of code alteration are not random either, but are shaped from the flow of the interaction. In this way, the child produces patterns that reflect more of an interaction and less of just direct switching, since what they say in one language takes its meaning from what has just been said and what is about to follow.¹³⁸

The third mechanism mentioned is negotiation, which we will best comprehend in the light of a study conducted about bilingual children in both French and German. For these children, growing up with two languages meant that their developing grammars for both languages had to engage in a process of negotiation, in which the children increased the use of structures that are shaped by both languages. They did not produce words in an order that was foreign to either language but instead used overlapping word patterns more frequently than a monolingual speaker would. A similar process was also observed in phonology, where bilingual children learning Turkish and German developed intonation patterns that differed in sound across these two languages, but ultimately served the same communicative function.¹³⁹

So, children's knowledge of two different languages did not result in mixing or confusion, but resulted in them keeping both languages systems compatible and allowing them to coexist. Tracing back to earlier discussed perspectives, acquisition does not depend solely on the external input children receive, but on an interaction between a child's biologically grounded capacities and the linguistic environment it grows up in. In this sense, the ability

¹³⁸ Ivi, pp. 115-135.

¹³⁹ Sarah G. Thomason, *Language Contact: An Introduction*, Edinburgh University Press, Edinburgh 2001.

to maintain not one but two linguistic systems can be understood as the consequence of two factors: exposure to two different languages and a flexible cognitive structure that supports language and can accommodate multiple systems simultaneously. One thing to have in mind, however, is how different French and Turkish are in comparison to German. If we wanted to examine them further, we would encounter completely different phonological systems and grammatical structures and if bilingual children were being exposed to them, they would encounter clearer structural contrasts than between two closely related language pairs.¹⁴⁰

A good example of two closely related language pairs is Spanish and Catalan, that share many rhythmic and phonological properties and are in the center of the following study that demonstrates that separation between languages for bilingual children comes surprisingly early. By four to five months of age, infants can already distinguish between their two input languages and they do so without any developmental delay in comparison to monolinguals, demonstrating that early exposure to two linguistic systems does not hinder perceptual development. This finding is particularly important because distinguishing between rhythmically close languages is considered more demanding and difficult than those that are rhythmically distant.¹⁴¹

More recent work by, among others, one of the researchers from the previous study, suggests that infants do not just isolate auditory information, but instead integrate visual cues to support their language differentiation. The study found that switches between closely related language are more difficult to detect than those that involved a distant

¹⁴⁰ Ibidem.

¹⁴¹ Laura Bosch, Núria Sebastián-Gallés, *Evidence of Early Language Discrimination Abilities in Infants from Bilingual Environments*, in “Infancy”, 2 (2001), pp. 29–49.

language, which resulted in infants attending to visual information, such as mouth movement, as a signal of a change in language. This is consistent with the evidence mentioned in the previous subchapter which showed how infants managed less clear auditory cues by focusing on the visual information on the speaker's face. By shifting their attention when auditory information is ambiguous, bilingual infants show an early sensitivity not only to the richness, but also to the structure of their linguistic environment.¹⁴²

These adjustments that infants make are not isolated and they accumulate over time to influence how each language develops. One outcome of this adaptation is the emergence of language dominance, where one language becomes temporarily either more robust or more accessible than the other. Language dominance is a phenomenon that occurs when a child's two languages are supported by different amounts and different types of input, a process that remains dynamic and therefore shaped by experience and the ongoing cognitive development. In other words, it is not a fixed characteristic a bilingual child has, but rather changes over time as social environments change, such as when children enter the school system or experience changes in the way languages are used at home. Some research might suggest that dominance could play a key role in explaining why some linguistic patterns emerge more strongly in one language and persist longer in the other

¹⁴² Joan Birulés, Ferran Pons, Laura Bosch, *Early Audiovisual Language Discrimination: Monolingual and Bilingual Infants' Differences in Language Switch Detection*, in "International Journal of Behavioral Development", 48 (2024), pp. 467–473.

and define language dominance in terms of proficiency, which states the dominant language of the child is the one that appears more advanced or more fluent.¹⁴³

However, the Yip and Matthews' (2007) view defining dominance solely in terms of proficiency as problematic, as the notion of proficiency is rarely used in monolingual children research, where the focus is then placed on how the linguistic knowledge develops over time. They view dominance as competence-based, not just performance-based, and argue that dominance remains valuable if it is understood not as a measure of performance, but as a reflection of linguistic competence.

Another approach aligned with Yip & Matthews' agrees on the core idea but pushes it further by encouraging dominance being reframed as an analytical tool, not a child attribute. Instead of viewing it as a global characteristic of the child, it suggests that it's better understood as a complex phenomenon that can vary between different linguistic domains and developmental stages. A child may show greater strength in one language at a vocabulary level, while relying on the other language for grammatical structures or just a higher efficiency in conversations. This variability is what makes it difficult to assign a single dominant language. This view also emphasized that the role of input is crucial, but that dominance does not arise from exposure on its own. Children actively engage with the languages around them and the dominance emerges through interactions between their

¹⁴³ Yip, Matthews, *The Bilingual Child*, op.cit.

experience and their language use, as well as their cognitive processing, so it has a developmental tendency that can shift as the child's environment and needs change.¹⁴⁴

Nevertheless, input is consistently identified as a crucial factor in bilingual development, so the next step would be examining closer the relationship between language input and bilingual language outcomes. In a study of bilingual children that spoke French and English, it was examined how various input factors relate to vocabulary development in both languages. Using standardized measures of receptive vocabulary alongside parent questionnaires, it was found that children's language proficiency in each language closely reflected their overall exposure to that language. When exposure to one of the languages was lower, children's performance in that language was reduced and the results also showed that current patterns of input and output were predictive of proficiency, especially for the minority language that depended heavily on use in the home environment. When English was not present in family interactions on a regular basis, it was more difficult for children to develop it and maintain it.¹⁴⁵

However, while the home environment plays a central role in maintaining the minority language, it's important to keep in mind that it's not the only context in which meaningful input can be provided. Exposure in schools is also a powerful source of support, as early instructions on developing a second language can significantly enhance children's

¹⁴⁴ Katja Francesca Cantone, Tanja Kupisch, Natascha Müller, Katrin Schmitz, *Rethinking Language Dominance in Bilingual Children*, in "Linguistische Berichte", 215 (2008), pp. 307–343.

¹⁴⁵ Cathy Cohen, *The Relationship Between Input Factors and Bilingual Proficiency: Evidence From French–English Bilingual Children, Bilingual and Multilingual Interaction*, Bangor University, United Kingdom, March 2012.

engagement and use of their weaker language, as long as the input is being presented through interactive and multisensory activities.¹⁴⁶

Such classroom practices as passive listening, active speaking and creative activities (singing, dancing, drawing etc.) in solving meaningful tasks can help develop the second language that might otherwise receive more limited input at home. This suggests a solution through school, which can partly compensate for imbalances in language exposure at home and reinforce the idea that bilingual development can continue to develop if the child has a consistent source of input in at least one area of its environment.¹⁴⁷

Having considered the role of both home and school environments, we can turn to the kind of individual input source that constitutes the largest part of children's daily language exposure, which is the caregiver's input. Language used by caregivers within the family is not simply a practical choice, but a pattern shaped by habits and emotional bonds that already exist between family members. Once a particular language becomes the medium through which family bonds are built or even maintained, it is very difficult to change it later, even if parents make conscious attempts to do so for the sake of the child's bilingual development. The language between caregivers carries personal meaning, making it more resistant to structuring, as opposed to the input the child receives through the school system which is easier to structure.¹⁴⁸

¹⁴⁶ Matteo Greco, *A Brief Practical Guide for L2 Teachers: K–2 American Children Learn Italian*, in "Italiano LinguaDue", 1 (2021), pp. 141–156.

¹⁴⁷ Ibidem.

¹⁴⁸ Edith Harding-Esch, Philip Riley, *The Bilingual Family: A Handbook for Parents*, Cambridge University Press, Cambridge 2003.

For this reason, the successful bilingual input in the home does not depend on altering the communication patterns that the parent already established throughout their relationship, but rather on how caregivers address their child through those patterns. This shifts more attention to the nature of the interactions between the child and their caregiver and to the linguistic input that the children receive through their everyday routines, both in the sense of quality and quantity.¹⁴⁹

A great lens through which we can observe the quality and quantity together is the work of Van de Weijer, specifically her longitudinal study in which she analyzed the speech of a bilingual mother addressing her infant and found that large parts of utterances could not be clearly classified as belonging to one language. While the mother used both German and Dutch when interacting with her child, nearly half of her daily utterances consisted of reduced or more ambiguous forms that are typical of infant directed speech. The pattern observed here suggests that infants growing up in bilingual homes are not only exposed to two languages, but also to a lot of mixed input. Important thing to note here is that these indeterminate forms were a regular feature of infant-directed speech and occurred alongside a very high overall quantity of maternal speech, which can suggest that bilingual infants receive a dense, but structurally slightly reduced input. These input conditions highlight how central the role of the mother is as a source of exposure and also as the one who shapes the form in which language will be experienced first.¹⁵⁰

An additional insight taken from this longitudinal data is that this pattern of reduced input is not random and is quite stable across time. The amount of ambiguous utterances

¹⁴⁹ Ibidem.

¹⁵⁰ Joost Van de Weijer, *Language Input for Word Discovery*, Doctoral dissertation, Radboud University Nijmegen, LOT, Nijmegen 1998.

remained consistent across the recording period, leading us to the conclusion that this style of maternal speech represents a strategy, not just a transitional stage. When the same mother addressed adults, her speech changed in a way that included longer utterances and a more completed syntax, but above all it was easier to assign to a single language. This contrast especially interests us given that it is consistent with the discussion in the previous subchapter about child-directed speech, where mothers were shown to adjust their language when addressing their child.¹⁵¹

Building on Van De Weijer's original study, De Houwer re-analyzed and discussed her findings to mention the importance of child's age and communicative needs. Since the mentioned mother addressed both an infant, six to nine months old, as well as an infant approximately between two and a half and three years of age, the structure of the speech also varied depending on which child she was addressing. The toddler received nearly twice as many maternal utterances per day as the infant, leading us to the conclusion that the quantity of input increases substantially as children grow older, which also mirrors findings from monolingual contexts and suggest that children are exposed to input that evolves over time.¹⁵²

However, this difference cannot be attributed just to the age of the children alone. In the study of this family, the toddler was the firstborn and the infant was the second-born, a factor known to influence how much direct speech children receive from their caregivers. Firstborn children typically receive more one-on-one interactions, while children born later often share them with older siblings. This presents as an alternative view to interpret

¹⁵¹ Ibidem.

¹⁵² Annick De Houwer, *Bilingual First Language Acquisition*, Multilingual Matters, Bristol 2009.

these findings, shedding light also to the organization of family interaction. In addition to the differences in quantity, the quality of maternal input also shifted with age, since the reduced forms previously mentioned became more complex when speaking to the toddler, indicating a gradual increase in linguistic complexity when the mother was addressing the older child. As children mature, the input becomes more differentiated.¹⁵³

Tracing back to monolingual children's language development, De Hower also Hart and Risley's findings to show that children who hear more speech on a daily basis tend to develop larger vocabularies by the age of three.¹⁵⁴

Similar patterns also emerge in bilingual settings, looking at evidence De Houwer cited from a longitudinal data from English-Inuktitut families we can notice a relationship between how much caregivers speak and how much speech their children produce. Families in which adults were more verbally active had children who spoke more, although some rare exceptions were noted. These studies were, in fact, not designed to measure input quality as their primary goal, but can serve as great evidence in how important the amount of speech children receive is.¹⁵⁵

De Houwer further notes that bilingual children could not be even expected to acquire patterns of speech too similar to monolingual children, since their primary input is bilingual speech produced by caregivers who speak different languages, particularly at the level of rhythm and prosody. She found empirical support for this in a study about

¹⁵³ Ibidem.

¹⁵⁴ Betty Hart, Todd R. Risley, *Meaningful Differences in the Everyday Experience of Young American Children*, Paul H. Brookes Publishing, Baltimore 1995.

¹⁵⁵ De Houwer, *Bilingual First Language Acquisition*, op.cit.

three German-English speaking families in which maternal speech rhythm was directly compared to children's speech patterns using acoustic measures.¹⁵⁶

Across both languages, children's rhythm aligned more with maternal input, meaning that children's rhythmic patterns are closer to the mother's speech than the father's speech. In families where mothers used clearly distinct rhythmic patterns in German and English, children also developed two distinct rhythmic systems, but in families where the mothers themselves didn't differentiate rhythmically, their children did not either. This presents us strong evidence that maternal input shapes how bilingual systems are separated and indicates that bilingual children don't acquire these rhythmic categories in isolation, but attune to the phonetic characteristics already present in maternal input. Age was an important factor in this study as well, since the study shows that rhythmic differentiation emerges gradually with age. Younger children initially showed less differentiated rhythmic and gradually increased variability as they grew, this reflecting continued exposure and adaptation to the speech patterns of the mother over time.¹⁵⁷

More recent work by De Houwer and Bornstein focused more on this component, the continuity of language over time in bilingual families. Using observational and questionnaire-type data collected across several years, they followed mothers addressing their children from infancy, 5 months of age, into the preschool period of 53 months of age. Most mothers addressed their children quite consistently in a single language across the four-year period, suggesting that the choice of early language remains resilient, and when changes did occur, they were more likely to appear later in development, once

¹⁵⁶ Nicole Whitworth, *Speech Rhythm Production in Three German-English Bilingual Families*, in D. Nelson (ed.), *Leeds Working Papers in Linguistics and Phonetics*, 9 (2002), pp. 175–205.

¹⁵⁷ *Ibidem*.

children began producing more fluent speech and not in the pre-verbal or early word stages.¹⁵⁸

At the same time, detailed observational data revealed some deviations from mothers' self-reports. Even mothers who described themselves as strictly using one language occasionally used utterances in the other language during spontaneous interactions. Crucial to note is that the cumulative nature of maternal input stayed intact, which means that children continued to receive exposure to at least one, and often two languages across development. Taking these findings together, they can support the idea that consistency in the language choice of the mother can provide a good and quite stable foundation for bilingual language learning, even in cases of small variability.¹⁵⁹

Across the literature mentioned, bilingual language learning is consistently described as something children and their caregiver construct together, which helps us draw conclusions about how language actually operates in real family life. A central theme has been the role of code-switching and language mixing, helping us understand how languages could be used in different communicative situations and how the process of children learning to differentiate them looks like. Maternal input and language choice are seemingly a key mechanism that enables and supports bilingual development with longitudinal evidence revealing the shifts in input that mothers tend to make in regard to their children's age and observed capacity, alongside the continuity of the primary language they choose to address the child with. Overall, bilingualism is a process that

¹⁵⁸ Annick De Houwer, Marc H. Bornstein, *Bilingual Mothers' Language Choice in Child-Directed Speech: Continuity and Change*, in "Journal of Multilingual and Multicultural Development", 37 (2016), pp. 680–693.

¹⁵⁹ Ibidem.

remains relational and dynamic; children themselves influence how adults speak to them as much as adults influence their children. Bilingualism emerges through daily-life activities, through play and routine, stories and conversations, interactions which children often participate in with their mothers whose speech patterns and choices shape how these growing linguistic systems are built.

2.4. Maternal Input and Vocabulary Outcomes through the Lens of Interacting Factors

While the previous chapter framed bilingualism as a relational and dynamic process, the focus now turns to early language development and vocabulary outcomes in a broader sense, including children who live in monolingual environments. Shifting the lens from bilingualism doesn't mean abandoning the idea that language emerges through interaction, but rather serves in allowing us to examine how maternal input together with other factors, factors of the mother as well as of the child, shape possible vocabulary outcomes.

The quality of maternal speech, the emotions and affect present in interactions, the child's own temperament or even genes could be intertwined with the quantity and the quality of the language competence that the child develops. Lexical variety and syntactic variety during the first year of life is predictive of more advanced language competence the child showcases in the second year. Interestingly, this is not uniform across children: infants with stronger attention skills benefit the most, highlighting that the input quality interacts with developmental traits specific for each individual child.¹⁶⁰

As cited from Gartstein and Rothbart, by the authors of this study, temperamental traits are defined as "biologically based characteristics that manifest early in life, that contribute

¹⁶⁰ Maria Spinelli, Mirco Fasolo, Prachi E. Shah, Giuliana Genovese, Tiziana Aureli, *The Influence of Early Temperament on Language Development: The Moderating Role of Maternal Input*, in "Frontiers in Psychology", 9 (2018), Art. 1527.

to individual differences in regulating and modulating emotion, attention, behavior, and motor activity".¹⁶¹

Temperament plays a role in influencing how children acquire language, contributing to individual differences such as age of first word spoken or rate of vocabulary growth. Staying on the topic of syntactic skills, the first year of a child's life is a crucial period in which the child rapidly develops both syntactic and semantic skills, which further enables them to begin decoding speech and associate sounds with their symbolic meaning. This study further explores and examines how the quality of maternal input interacts with said temperament of the child to influence language outcomes. Temperament was assessed at three months using Infant Behavior Questionnaire-Revised that measured attention (specifically the duration of orienting), positive affect (specifically smiling and laughing) and negative effect (specifically distress showed).¹⁶²

On the other hand, maternal input was measured in terms of lexical variability, which stands for the number of different word types in a minute, and in terms of syntactic complexity, which stands for average length and complexity of sentences used. Maternal verbal input was transcribed in detail at 6, 9 and 12 months of age, which is what makes this study particularly interesting, because most studies on this topic focus on age groups of 24 months to 36 months. Maternal and infant speech was analyzed in the terms of utterances, that is continuous sequences of speech that were either separated by a longer pause or by a clear change in the conversational turn. This method allowed the researchers to seize meaningful units of communication, rather than just words or sounds on their

¹⁶¹ Ivi, p.1.

¹⁶² Ivi.

own. This gave a clearer and well-rounded picture of both the mothers' input and the child's attention and language. At 24 months, children's speech was also transcribed, and it was done in a way that excludes all non-verbal sounds (such as crying, for example) and the words were counted only if they were recognizable, used in more contexts and meaningful to the mother.¹⁶³

The results demonstrated that infant attentional skills were positively associated with later language outcomes, however, this was influenced with the quality of maternal input. Specifically, higher maternal syntactic complexity at the age of 6 months and higher maternal lexical variability at the age of 9 months helped attentive infants develop larger vocabularies at 18 months and the ability to construct more complex sentences at 24 months of age. Later maternal input, after the 12-month mark, was less influential, further suggesting that the timing of rich maternal language exposure matters.¹⁶⁴

However, it is important to keep in mind that the effectiveness of maternal input depends on not only its own complexity and richness, but also on the infant's ability to engage in the interaction and pay attention. For infants with low attentional abilities, exposure to a rich maternal input was associated with lower language abilities, since they may become distracted more easily and have difficulties in engaging fully in triadic engagements, that involve not only the mother and the child, but also other objects. In the context described, complex maternal language could act as a distraction and limit the ability of the infant to process and learn from the interaction. All of these findings could provide guidelines for supporting early language development, and while infants' attentional abilities shape how

¹⁶³ Ibidem.

¹⁶⁴ Ibidem.

well they can learn and engage in interactions, equally important is the responsiveness of the mother during said interactions.¹⁶⁵

Responsiveness is defined as “the prompt, contingent, and appropriate reactions parents display to their children in the context of everyday exchange.”¹⁶⁶

Research indicates that the way a mother responds to their infant plays a very important role in early language development and growth. In addition to responsiveness to a child’s signals, mothers who maintain joint attention, which is focusing on the same activity or the object the child is focusing on, supports vocabulary growth and cognitive performance as well. Moreover, guiding infants’ attention and helping them redirect their focus when they become distracted may lead to them obtaining larger receptive vocabulary in the second year.¹⁶⁷

On the contrary though, not all maternal behaviors support language growth and actions that interfere with the child’s initiative, such as controlling the child, can have neutral or even negative effects on language development. For example, maternal control during interactions, does not enhance the vocabulary acquisition and may limit the child’s opportunities to initiate communication. When the child does initiate communication, however, it is crucial that the mother does not reject or discourage this attempt, since this may lead to a poorer vocabulary later. In contrast to controlling behavior that constraints

¹⁶⁵ Ibidem.

¹⁶⁶ Marc H. Bornstein, Catherine S. Tamis-LeMonda, Chun-Shin Hahn, O. Maurice Haynes, *Maternal Responsiveness to Young Children at Three Ages: Longitudinal Analysis of Multidimensional, Modular, and Specific Parenting Construct*, in “Developmental Psychology”, 44 (2008), p. 867.

¹⁶⁷ Laura Baumwell, Catherine S. Tamis-LeMonda, Marc H. Bornstein, *Maternal Verbal Sensitivity and Child Language Comprehension*, in “Infant Behavior and Development”, 20 (1997), pp. 247–258.

the child's efforts, proper guidance can effectively engage the interest of the child and provide structure, while allowing the child to explore language actively.¹⁶⁸

So, what is proper guidance and how do mothers use and implement it effectively? Guidance is a form of support that the mother provides for the child that helps the child know what to notice and focus on, as well as how to connect with the world around it. Guidance happens during dyadic exchanges, in which the mother and her child spend time together and respond to each other. In this exchange, communication includes not only the words said, but also emotional expressions. These emotional expressions, or in this study referred to as “affect”, are a principal part of the exchange because children seem to learn language better if they are emotionally connected to the person talking to them. Given these facts, it is reasonable to assume that the guiding attempts are the most effective when the mother uses a warm and affective tone to engage her child's attention in learning.¹⁶⁹

As mentioned in the previous subchapters, the complexity of the language used is usually adapted to suit the age of the child and is changed constantly based on what the child can comprehend at the moment communication takes place. The caregiver will use simple commands and questions to get the child's attention and then using the “following-in” method to help the child maintain their attention on the object the child is already looking at or showing. This respects the focus of the child and does not control it or abruptly

¹⁶⁸ Ibidem.

¹⁶⁹ Shruti Dave, Ann M. Mastergeorge, Lesley B. Olswang, *Motherese, Affect and Vocabulary Development: Dyadic Communicative Interactions in Infants and Toddlers*, in “Journal of Child Language”, 45 (2018), pp. 917–938.

redirect it. These types of behaviors are positively linked to vocabulary development, as well as the cognitive development of the child.¹⁷⁰

On the topic of cognitive development, infants reach very important cognitive and neural milestones around 9 months on average. These milestones include mimicking different sounds they hear and actions they see others perform, babbling and experimenting with different sound structures, as well as showing a higher level of focus and pointing during dyadic interactions. Mothers who are attuned to the behavior that their child is demonstrating can result to a higher level of support in language learning, and conversely, infants that understand their mother's emotions, like smiles and frowns, tend to gradually respond more to their mothers over time, especially if this is paired with gestures or exaggerated speech quality motherese usually has.¹⁷¹

Building on this, this study aims to further explore how maternal affect and emotions shape the way infants perceive and benefit from guiding language, as well as how different types of guiding language, such as questions versus commands, have a unique effect on vocabulary development. Participants included typically developing infants and their mothers, who all spoke English as the primary language at home. Data was collected across four different time points: at 7 months and at 11 months, play sessions between mothers and their infants were recorded and later coded for maternal guiding speech and maternal affect, then later at 18 months and 24 months, the mothers reported their child's vocabulary using the MacArthur–Bates Communicative Development Inventories.¹⁷²

¹⁷⁰ Ibidem.

¹⁷¹ Ibidem.

¹⁷² Ibidem.

A clearer understanding of this instrument can be reached by taking a look at its definition, which states that “The MacArthur Communicative Development Inventories (CDIs) are a pair of widely used parent-report instruments for assessing communicative skills in infants and toddlers. This report describes short-form versions of the CDIs and their development, summarizes newly available normative data and psychometric properties of the instruments, and discusses research and clinical applications.” In other words, they are used so parents can self-report their child’s gestures, words and behaviours and monitor their child themselves across many situations, not only during play sessions.¹⁷³

Remaining on the topic of play sessions, they took place in laboratory rooms with infants sitting on high chairs with their mothers across a table. Each mother interacted and played with her child using a set of toys and rotating through them. All of the mother-child interactions were recorded, and later carefully transcribed. Each unit of speech, or utterance, was coded by two coders who worked independently and later categorized into a guiding utterance or non-guiding utterance, and the guiding one was later further later categorized as either a command, a statement used to direct the attention of the child or a question, used to further engage the child. Guiding utterances were also categorized according to focus, either they followed the child’s attention (following-in) or they redirected the child’s attention to another object or to the mom herself (directives). This detailed way of coding ensured that both the quantity and the quality of language input

¹⁷³ Larry Fenson, Steve Pethick, Connie Renda, Jeffrey L. Cox, Philip S. Dale, J. Steven Reznick, *Short-Form Versions of the MacArthur Communicative Development Inventories*, in “Applied Psycholinguistics”, 21 (2000), p. 95.

were taken into account, as well as how mothers scaffold their children's communication and interest.¹⁷⁴

The term "scaffolding" originates from earlier discussed Bruner and his colleagues in order to conceptualize how an adult supports a child whose goal is to solve a problem that it cannot currently solve on their own. By definition, the "scaffolding process enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts. This scaffolding consists essentially of the adult "controlling" those elements of the task that are initially beyond the learner's capacity, thus permitting him to concentrate upon and complete only those elements that are within his range of competence."¹⁷⁵

Returning to the study, maternal affect was also coded and mother's emotional state was evaluated with a numerical score based on her vocal intonation and emotional expression. A key scale that was measured is the dominance scale, which reflected the mother's degree of control, ranging from no control to frequent attempts to control her child's actions. The higher the score, the higher the degree in which the mother demonstrated behaviors that physically or verbally commanded attention. The score was averaged across the four different toys that were used in a play session, to generate a total score and ensure that it consistently represents the degree of maternal dominance.¹⁷⁶

The results showed that at 7 months, mothers who used more following-in language also used fewer commands directed to their children, meaning that they mostly just followed

¹⁷⁴ Dave, Mastergeorge, Olswang, *Motherese, Affect and Vocabulary Development*, op.cit.

¹⁷⁵ David Wood, Jerome S. Bruner, Gail Ross, *The Role of Tutoring in Problem Solving*, in "Journal of Child Psychology and Psychiatry", 17 (1976), p. 90.

¹⁷⁶ Dave, Mastergeorge, Olswang, *Motherese, Affect and Vocabulary Development*, op.cit.

and supported what their child was already interested in. However, at 11 months that dynamic slightly shifted, indicated that the mothers became more flexible in balancing following in language and redirecting strategies, according to how their children's comprehension and communication was developing. Further correlational analysis showed that different aspects of maternal behavior were linked to their child's later vocabulary in distinct ways. At 7 months, previously mentioned following-in commands were slightly related to vocabulary at 24 months, moreover by 11 months this correlation became more apparent and further suggesting that supportive language that follows the child's focus becomes more important as the child grows older.¹⁷⁷

In contrast to these findings, it was also found that maternal dominance, or behavior that emphasizes control, was negatively related to vocabulary at 18 and 24 months. It seems that more controlling mothers tended to have children with smaller vocabularies and that this kind of behavior also negatively influenced further vocabulary growths, as opposed to mothers who used following-in language which they increased with time. In fact, this increase and change was the strongest predictor of later vocabulary and the most beneficial for child vocabulary development. These findings highlight how maternal verbalization and affect each made independent contributions to the vocabulary development of the children, responsive guiding language supported vocabulary growth while higher maternal dominance hindered it. Moreover, they emphasize the importance of flexible maternal behavior in early language development.¹⁷⁸

¹⁷⁷ Ibidem.

¹⁷⁸ Ibidem.

While previous findings highlight the importance of flexible maternal behavior, they also raise a broader question: to what extent are these effects caused by parental input rather than shared genes? Studies of adopted children, who share no genes with their caregivers, can help us take a closer look at this topic. A large body of research that shows that the growth of children's vocabulary is related to both the quality and quantity they hear in their homes is already available across many different cultures, languages and socioeconomic backgrounds. They all form the basis of the "input hypothesis" which states that input is what plays the biggest role in early language acquisition. Opposed to it is the "genetic counterhypothesis" which states that these correlations could be explained by the simple fact that parents and children share genes. Specifically, parents who naturally use more complex or more frequent language may have children who are naturally predisposed to stronger language skills. Although there have been only a few studies that directly examined whether adults' speech to their children is inheritable, we do know that language abilities and its individual differences are very stable across lifespan and that there are traits that have a substantial genetic component, for example talkativeness.¹⁷⁹

Moreover, studies examining parental engagement such as talking, reading, or singing have found that nearly 30% of the variation in parental input can be assigned to children's genetically influenced characteristics. This further implies that children with genotypes promoting language and engagement in social situations elicit recurring and higher quality language input from caregivers, or in other words, if a child has genes that make

¹⁷⁹ Joseph Coffey, Carissa L. Shafto, Joy C. Geren, Jesse Snedeker, *The Effects of Maternal Input on Language in the Absence of Genetic Confounds: Vocabulary Development in Internationally Adopted Children*, in "Child Development", 93 (2021), pp. 237–253.

them more curious or responsive, the parent will naturally talk more to that child. On the contrary, if the child is quieter or less responsive and overall, less engaged in social situations, the parent may end up talking less even if they don't want to or realize it at times. Seemingly, not all parental input is a conscious parental choice, some of it may be influenced by child's genetically influenced behavior.¹⁸⁰

While the original study also included preschoolers, this analysis will focus on the infant sample and primarily examine early language development. The infant sample mentioned included infants from China, currently aged 1 year 3 months to 2 years eight months but adopted between 6 and 16 months of age to ensure they were living in the United States for at least 7 and up to 20 months at the time of testing. All children were developing typically and were placed in monolingual English-speaking households. Families recorded the play sessions between mothers and their infants using a standardized set of toys, after which the mothers completed the already mentioned MacArthur-Bates Communicative Development Inventory: Words and Sentences form (CDI) within the same months that the recording occurred. Each infant participated in one to twelve play sessions, depending on the sampling schedule and study participation. Mothers in this sample were highly educated, with either college level or graduate-level degree, and their speech was analyzed for four measures.¹⁸¹

The first measure was mean number of word tokens per minute, which reflects the quantity of input and counts how many words the mother speaks to the child. The second measure was mean number of word types per minute, capturing lexical variety, or in other

¹⁸⁰ Ibidem.

¹⁸¹ Ibidem.

words, how many different words the mother uses per minute. The third measure was mean length of utterance (MLU) that assessed morphemic complexity in terms of the average number of morphemes included in each sentence the mother says. Finally, the fourth measure was proportion of utterances that are questions, used for indicating the interactional styles, that is how much the mother encourages the child to respond or engage, as well as how often she asks questions during interactions no matter the type of questions used. The researchers adjusted infant vocabulary scores for time they spent in the U.S. and age at which they were adopted. This accounts for the fact that children who arrived earlier or had more exposure might naturally know more words. The residual score represented vocabulary growth after controlling these factors, further isolating the effect of maternal input.¹⁸²

Among all four speech measures previously mentioned, mean length of utterance (MLU) was the strongest predictor of vocabulary growth, with other measures improved the model only slightly but not nearly as much as MLU, not even adding combinations of two predictors improved the model beyond MLU alone. Conversely, removing some predictors improved model fit suggesting that not all measures were equally important and proposing that the complexity of maternal speech, rather than is quantity or diversity, plays a central role in shaping vocabulary acquisition even in the absence of a shared genetic relationship.¹⁸³

Previous studies have also shown that children moving from low-input environments, for example institutions, to higher-input settings experience quite significant gains in both

¹⁸² Ibidem.

¹⁸³ Ibidem.

first and second language acquisition, which further demonstrates that enriched linguistic environments facilitate language growth. Although the present study cannot directly investigate interactions between genes and environment, some previous research in the area of behavioral genetics suggests that such interactions may play an important role in early cognitive development. One of them suggests that in lower-income families, children's cognitive outcomes are shaped more strongly by their environment than by genetic differences, whereas an opposite pattern is present in higher- SES families. This could prove that parental input may have a stronger impact on children's learning in contexts and environments where sources are limited. Because the sample in the previously mentioned study involved highly educated mothers who adopted the children into relatively similar families, we would not expect to see a strong interaction between environment and genes here.¹⁸⁴

To explore how socioeconomic context can amplify the role of input, the next study focuses on mother-child communication in families whose income is low and further examines how language of these mothers predicts children's vocabulary growth. This study aimed to fill some gaps in the understanding of vocabulary development among children from low-income backgrounds. Primarily, it sought to provide detailed descriptive data on the observed vocabulary use, followed by tracking how children's vocabulary production changed between ages one and three using individual growth

¹⁸⁴Eric Turkheimer, Andreana P. Haley, Mary Waldron, Brian D'Onofrio, Irving I. Gottesman, *Socioeconomic Status Modifies Heritability of IQ in Young Children*, in "Psychological Science", 14 (2003), pp. 623–628.

modelling. Finally, it examined whether the factors already known to predict vocabulary growth in middle class samples also operate in low income families.¹⁸⁵

Growth models incorporated several control variables, such as the gender of the child, the birth order of the child, maternal age, family income, and program status. The central research questions primarily tried to describe patterns of vocabulary growth and determine whether maternal communicative behavior, educational background, language and literacy skills, as well as maternal depression predicted differences in children's rates of vocabulary development over time. After enrollment, families were randomly assigned to either the intervention or comparison condition, and both of the groups were included in the present study.¹⁸⁶

The procedure was organized through three sessions that occurred when children were approximately 14, 24 and 36 months old, though the analysis used each child's exact age, which further improved model fit. During each home visit, mothers and their children received three bags that contained an age-appropriate book and toy designed to encourage talking and pretend play. Mothers were instructed to start with the book bag but were free to manage the timing and order within a ten-minute interaction, leading to a natural variation in how long dyads engaged with each item. Time spent with the book did correlate with maternal communication measured but not with the child's vocabulary production. All sessions were recorded and transcribed, capturing both verbal and nonverbal communicative behaviors, including gestures, proceeded by a check for

¹⁸⁵ Barbara A. Pan, Meredith L. Rowe, Judith D. Singer, Catherine E. Snow, *Maternal Correlates of Growth in Toddler Vocabulary Production in Low-Income Families*, in "Child Development", 76 (2005), pp. 763–782.

¹⁸⁶ Ibidem.

accuracy and consistent spelling to further ensure correct counts of word types. The unit of transcription was defined as one complete communicative act and it was separated based on a grammatical close, a pause longer than two seconds or a change in the speaker. This means that every time the mother or the child produced a new and meaningful verbal or gestural act, it was deemed a separate unit. Pointing gestures were coded whenever the index finger indicated an object or a person, while guided pointing, in terms of the mom moving the child's hand was excluded.¹⁸⁷

The findings showed that early vocabulary development is not just a result of time or a sole exposure to speech, but is intertwined with the quality of the input coming from the mother and her overall well-being. Children's productive vocabularies grew quite steadily between 14 and 36 months, gaining roughly about two words a month, but this growth did vary across individual infants, reflecting differences present in their communicative environments. In particular, communicative environments in which the mothers used a more diverse range of words resulted in their toddlers advancing more rapidly, suggesting that it isn't only important how talkative the mothers is, since her talkativeness alone showed no predictive power, while her lexical richness did and literacy skills did. This effect was especially visible around the age of two, which is a period of heightened neural and linguistic plasticity.¹⁸⁸

Conversely, a higher level of depression in mothers was associated with slower vocabulary growth, showing how emotional factors can also be of great influence in the

¹⁸⁷ Ibidem.

¹⁸⁸ Ibidem.

communicative environment and influence or slow down language development in children.¹⁸⁹

The studies reviewed in this chapter portray that children's emerging vocabularies are constructed through the interplay of maternal language, interaction, communicative environment of the child and mother's affect. Early vocabularies seem to be something that grows out of relationships and not something simply accumulated from exposure to words. Children learn most effectively not only when they find themselves surrounded by language, but when they are attentive and active participants, surrounded by warmth and responsiveness. Rather than just isolating one decisive factor, the evidence suggests that a strong vocabulary is built when all these factors interconnect. Throughout this chapter, we have found insights from different hypothesis and theories, from nativist ideas associated with Noam Chomsky, interactionist views coming from Jerome Bruner to a synthesis through the multifactor hypothesis which emphasizes the role of both input and interaction. In an effort to bring the different evidence discussed into coherence, the next chapter will examine the attachment theory and adapt it to a context which connects attachment, cognition, and early communication.

¹⁸⁹ Ibidem.

Chapter 3 : From Relationships to Communication

3.1. The Attachment Theory

Throughout previous chapters, we examined how important maternal input is and how it shapes early language acquisition of the child from biological and developmental perspectives, becoming aware how infants are already sensitive to their mother's voice, prosody, rhythm, even speech patterns before they fully understand the meaning of her words and sentences. Before language becomes a system structured through grammar and meaning, it exists as an experience, told through gaze and touch; tone and emotional attunement. Language is, therefore, not developed in isolation within the child's brain, but developed in an emotional context of the relationship between the mother and her infant.

To fully be able to grasp why and how maternal input matters, it is not sufficient to only consider linguistic structures or their neural mechanisms, but also the context and framework in which the input occurs. This is where we encounter the basis of the "Attachment theory", proposed by John Bowlby and Mary Ainsworth, and grown out of curiosity and clinical observation. The roots of this theory can be traced back to 20th century, in 1944 when Bowlby did his study on juvenile delinquency, in which he found a pattern that would later serve as a foundation to his theory and over the following decades his insights evolved into a widely known influential theory of attachment, positioning caregiver relationships as very much central to psychological development.¹⁹⁰

¹⁹⁰ Jude Cassidy, J. D. Jones, Phillip R. Shaver, *Contributions of Attachment Theory and Research: A Framework for Future Research, Translation, and Policy*, in "Development and Psychopathology", 25 (2013), pp. 1415–1434.

Attachment theory gained a level of empirical strength through collaborating with Mary Ainsworth, whose work helped move more abstract ideas of attachment into observable patterns, through very detailed observations of mother-infant dyad interactions. She was able to identify specific qualities of maternal behavior that led to different forms of infant attachment and together with her development of the “Strange Situation Procedure”, she was able to offer a standardized way to classify attachment security and insecurity, a methodological approach which validated all of the Bowlby’s ideas and sparked interest in a topic that would lead to a major body of research that continued in the future and shapes developmental psychology to this day. Scientific institutions acknowledged that early environment is fundamental in healthy development and by the 21st century, research demonstrated that consistent care and emotional availability are central in productive development and helping children thrive.¹⁹¹

Attachment theory was later expanded to go a step further and show how these attachment patterns can be transmitted through generations, which served in linking parent’s own attachment styles to their children’s attachment styles and later even broader, beyond the caregiver-child dyad to include attachment processes throughout one’s lifespan, supporting Bowlby’s view that attachment remains a core aspect of human experience from infancy through adulthood.¹⁹²

Before proceeding, let us return to the study from which it all began, in his book “Forty-Four Juvenile Thieves” Bowlby’s work was centered around responding to a bigger problem in social research at the time, the problem of juvenile delinquency. His study was

¹⁹¹ Ibidem.

¹⁹² Ibidem.

an attempt to move above pure social explanations of delinquency which were treating it as only a legal and moral issue. Instead, he approached it as a psychological and most importantly, a developmental phenomenon, giving an implicit assumption that the roots of later behavioral difficulties cannot be understood without looking at early experiences involving the mother. Through the examination of 44 cases, both children and adolescents referred because of stealing, he oriented his analysis toward the children's developmental histories and implied that the mother, as a key figure, is not just a mere provider of basic needs to the child. What happens between the mother and the child in the earliest years is central to understanding later outcomes.¹⁹³

Bowlby observed a pattern across cases that described those separations that occurred before the age of 5, as the most damaging and psychologically pathogenic, as well those separations that lasted months or years or eventually involved foster placement. He suggested that separations occurring after the first 6 to 12 months of life, once the establishment of earliest emotional bonds has been made and then disrupted may carry particular developmental consequences, and therefore, his emphasis remained on very early developmental periods when the child is forming their first emotional bonds, critical issue being the interruption of an already established relationship. He then built his case on his views by associating prolonged mother and child separations in these critical early years with, what he calls, an "affectionless character". The children in his cases were described as lacking emotional warmth and showing very little guilt of their behavioral patterns, engaging in persistent stealing.¹⁹⁴

¹⁹³John Bowlby, *Forty-Four Juvenile Thieves: Their Characters and Home-Life*, Baillière, Tindall & Cox, London 1947.

¹⁹⁴Ibidem.

The concept of a “broken home”, very widely used, grouped together a variety of different situations one could have in their home environment under a single sociological label, potentially obscuring what is psychologically significant for the child. Parental death, hospitalization, illegitimacy or family instability on their own were not enough for him to offer a well-rounded explanation of delinquency. A family could be socially defined as broken without disrupting the child’s primary emotional bond necessarily. His description of delinquency lacked ideas as simple as rebellion or immorality, and implied that emotional development itself has been altered, linking relation disruption with emotional disturbance, which together led to the delinquent behavioral outcomes.¹⁹⁵

Key findings of this work showed that a much higher percentage of these delinquent children had experienced prolonged separation from their mothers compared to control groups, and among those labeled as affectionless, the association with early separation was especially strong with 14 out of 16 affectionless children in one grouping having experienced prolonged maternal separation.¹⁹⁶

Does that mean all of the children found themselves in prolonged situations that lacked their mother’s physical presence? According to Bowlby, not necessarily. Even after the children returned home after hospitalization or mentioned foster care, they might have felt rejected or emotionally disconnected from their family, which introduced the question of the disruption of emotional continuity. From that point we can also consider other variables that might interfere and cause developmental influence: genetic factors, exposure to an ambivalent or hostile mother in addition to the prolonged separation from

¹⁹⁵ Ibidem.

¹⁹⁶ Ibidem.

the mother, the actively rejecting father in the early years and possible later traumatic influences. For most of the children described in the cases, more than one factor was present, so we cannot attribute the delinquency to a sole single cause, and even though early maternal separation appeared repeatedly as one of the most significant and consistent factors, the model remains multifactorial with the intruding of the other factors.¹⁹⁷

There was a certain distinction between less serious thieves, habitual thieves, as well as different character types that were marked as affectionless, depressed, hyperthymic etc. In the less serious groups, etiological factors often didn't differ from controls, but among habitual thieves and those with affectionless characters, patterns of higher strength emerged and suggested a kind of range in these cases in which more severe disturbances aligned with more persistent delinquency. Nevertheless, when examining the most emotionally detached and repeatedly delinquent cases, in those described as "affectionless", there was the most prolonged disruption of the mother and child relationship, and their stealing was interpreted as symbolically connected to the child's unmet emotional needs. In this sense, in the deprivation of mother's presence and affection, one may seek substitute forms of gratification through objects. Food or possessions could potentially take on emotional significance and function as a kind of a substitute for maternal care, because when early desire for comfort remains unfulfilled, it may reappear in distorted forms. In this context, the absence of the maternal bond, or at

¹⁹⁷ Ibidem.

least a stable one, does not eliminate the child's need for connection but alters the ways in which the need is expressed.¹⁹⁸

This was the path in which Bowlby moved beyond descriptive accounts of juvenile delinquency toward a framework more etiological, in which the child's earliest attachment relationships played an organizing role and interacted with other factors, to potentially interfere with the development of stable emotional ties in a more general sense. Without the attachment figure that shows stability and care, the child may struggle to form other lasting bonds in their life, and their emotional responses could become detached or sometimes displaced.¹⁹⁹

Bowlby's clinical observations continued into his new work on behalf of the World Health Organization, in which he sought to move the implications of disruption of the emotional world of the child beyond individual cases of delinquency and share more of his views and evidence on the topics of developmental organization and early bonds.²⁰⁰

Biological maturation tends to unfold within a meaningful relationship with a stable mother or a mother-substitute (for example, a foster mother present in their child's early life) and it is within this relationship that a child learns how to gradually regulate anxiety, manage guilt, tolerate the frustration that builds up and integrate the conflicting impulses it may have. Therefore, when the relational environment of the child is reliable, it enables its emotional life to develop in a stable and coordinated way, in which the continuity should not be interrupted. In case of interruptions, whether it happens through

¹⁹⁸ Ibidem.

¹⁹⁹ Ibidem.

²⁰⁰ John Bowlby, *Maternal Care and Mental Health*, World Health Organization, Geneva 1951.

institutionalization or inconsistent care, the inner organization of the child that has just begun to form may fragment and result in the excessive need of attention and anxiety. The child may encounter the feeling of resentment and struggle to bring itself back to baseline, demonstrating a range of behaviors out of which we already discussed one, delinquency.²⁰¹

This argument was then extended by proposing the different stages of a child's development, each characterized by specific needs and the first one referring to the first months of life in which the infants starts to form a bond with the caregiver figure, then followed by a period of strong dependence of the infant on said caregiver in which the caregiver's presence is essential. Only gradually is the child able to acquire the capacity it will need later, to sustain their relationship mentally even if the caregiver is absent. If the separation happens before the child reaches this level of capacity, not only does the child feel at distress, but the foundation of their security could be compromised, an effect often seen in institutions without individualized forms of care when the deprivation can get so profound that the child's ability to form meaningful emotional ties is very impaired. Bowlby does not present these disturbances in development as a result of weakness or even what we can call a "hereditary determinism", he acknowledges the constitutional factors and a role they may play, but his emphasis still remains of early developmental conditions and both the quality and the quantity of the child's primary relationship.²⁰²

A comparison with biological growth he draws from is that just as the body requires a level of exposure to a condition at specific stages in order to develop in a normal way, the

²⁰¹ Ibidem.

²⁰² Ibidem.

mind depends on experiences during critical periods, so a mother functions as what he describes an “organizer” of the child’s mental life that through ongoing interaction supports the development of the child’s ego and superego.²⁰³

As we can notice, Bowlby was still working with a psychoanalytic vocabulary and Freud’s model in mind, in which the ego and superego emerge through the child’s early relational experiences and processes of identification.²⁰⁴

Bowlby retained the terminology, but relocated the foundation from instinctual conflict to the continuity and quality of the relationship between the mother and the child. This gradually helps the child move from immediate impulse towards a more regulated behaviour and remains a process that develops through mentioned stages, which much like physical maturation, occur within sensitive time periods during which the child is especially responsive to environmental influence. Through repeated interaction with a consistent caregiver, the child gradually develops this ability to inhibit certain impulses and anticipate possible consequences and when this continuity is interrupted, they might struggle to develop the abilities of abstraction and planning of their behavior while remaining driven by immediate desires and impulses.²⁰⁵

The inability to pursue long term goals that may emerge we cannot interpret as a deficiency the child inherited, we can interpret is as the outcome of interrupted relational development and separation. When a child has formed a stable kind of attachment during the first year or two of life, sudden separation from the caregiver does not simply interrupt

²⁰³ Ibidem.

²⁰⁴ Sigmund Freud, *Das Ich und das Es*, Internationaler Psychoanalytischer Verlag, Vienna 1923.

²⁰⁵ Bowlby, *Maternal Care and Mental Health*, op.cit.

their future development, but disrupts the capacities the child has previously acquired. In such cases, the child may regress to more primitive modes of functioning and become excessively dependent on the mother figure for regulation, while the separation from her elicits the sensation of helplessness and confusion. At this emotional level, separation and deprivation generate ambivalent or hostile attitudes towards the mother figure, some children even fail to recognize their mother upon reunion, the explanation for this being either a regression in their ability to identify figures that are already familiar or as a form of defensive avoidance rooted in resentment, since the child already perceived abandonment.²⁰⁶

This hostility that may emerge takes us back to the beginning, with possible outcome being delinquent tendencies we already discussed evidence for, or possible manifestations of aggression, even potential withdrawal from relationships altogether.

An inner conflict arises between the desire of affection while simultaneously feeling anger toward the attachment figure, with further repetition of disruptions in this relationship could then lead the child to avoid emotional closeness completely as a self-strategy against future loss, even though the need for attachment and closeness stays present. The severity of consequences could depend on many factors, but in Bowlby's view the timing is a leading one since separations that occur after the age of three or four appear less damaging to core ego and to cognitive development.²⁰⁷

On the other side, timing in a more specific sense could feel entirely subjective, especially since a child has limited sense of time and what an adult may perceive as a short absence,

²⁰⁶ Ibidem.

²⁰⁷ Ibidem.

a child might perceive as endless and indefinite, amplifying then their anxiety further and contributing to the psychological impact of maternal deprivation.²⁰⁸

Another aspect of deprivation is emphasized through the examples of symbolic play or shared routines with their family members. These opportunities provide the child a chance to practice their emerging ego functions and responsive communication. In contrast, a young child growing up in institutional settings is encountered with the lack of these relational experiences, since play materials are limited and exchanges with caregivers are absent for the most part, even showing individual initiative in this kind of a setting might be discouraged, depriving the child of the experiences and contexts necessary for the consolidation of social competence, self-control and quite importantly, emotional warmth. The adequacy of a child's home environment cannot be understood solely in a structural sense, but also in terms of functions that it fulfills for the developing child that is biologically and psychologically still immature and depends on their environment for the satisfaction of both physical needs and needs for affection and security²⁰⁹

Within this perspective, emotional warmth can definitely be conceptualized as a part of an even broader continuum of parental acceptance and parental rejection. According to Rohner, parental acceptance refers to the affection and care that a caregiver communicates to the child, and that therefore makes the child feel valued and loved. This warmth can be expressed in many ways, through physical behaviors, for example hugging the child or comforting them, and verbal expressions, for example praise, encouragement, positive statements that are directed towards the child etc. These behaviors do not operate in

²⁰⁸ Ibidem.

²⁰⁹ Ibidem.

isolation, the cumulative presence of different behaviors mentioned over time helps the child perceive that it is being cared for and accepted.²¹⁰

Conversely, the absence of warmth could manifest through hostility or indifference towards the child, in more severe cases even neglect of the child, all of which contribute to the child feeling emotionally unsupported and experiencing themselves as unwanted.²¹¹

The implications of emotional warmth are very evident in situations in which the basic needs are technically met yet the relational quality of care differs. Regarding this, researchers began to ask whether attachment emerges primarily from biological gratification and basic needs met, for example feeding, or from the experience of security and feeling of comfort provided by the caregiver. A leading theory at the time highlighted that infants become attached to their mothers since she primarily provided them with food, so affection was understood as a conditioned response associated with drive reduction, but there was one component missing - love.²¹²

Freud's position regarding the infant's relationship with the mother developed over the course of his work, moving away from his initial idea of auto-erotic beginnings towards the recognition of an object-directed bond. Freud described the maternal figure as the child's first and most powerful love object, as well as the prototype for upcoming relational patterns across life. This formulation of the maternal figure suggested that the attachment in fact could not be reduced just to the satisfaction of physiological needs, with Bowlby interpreting this shift in evidence as Freud himself questioning the strict

²¹⁰ Ronald P. Rohner, *Patterns of Parenting: The Warmth Dimension in Worldwide Perspective*, in W. J. Lonner, R. S. Malpass (eds.), *Psychology and Culture*, Allyn & Bacon, Boston 1994, pp. 113–120.

²¹¹ Ibidem.

²¹² Harry F. Harlow, *The Nature of Love*, in "American Psychologist", 13 (1958), pp. 573–685.

explanations of the time. By revisiting these ideas that Freud had in his later career, Bowlby positioned his own framework for attachment.²¹³

In formulating his own framework, Bowlby first examined the competing explanations of the time that had dominated the field. The view that we already mentioned, proposed that infants form connections to their caregivers primarily because those caregivers satisfy their physiological needs, in this case their attachment would emerge through learned association. Alternative perspectives, such as Freud's first works he gradually moved from, suggested that the infant already had an innate orientation towards specific body experiences such as sucking the breast, or even just to remain close and clinging to a human. More speculative propositions framed attachment as just an infant's wish to return to prenatal unity. Bowlby wasn't satisfied with any of these perspectives alone, arguing that none of them could sufficiently capture how complex mother-infant relationships are on their own. Instead, his proposal was that attachment behaviour arises from a set of behavioural systems that are biologically based, present in early life and that operate in a relatively independent way, before they finally become organized around the specific caregiver the child has.²¹⁴

These systems include behaviors such as clinging, crying, and following so they can maintain the proximity between the infant and caregiver, while crying and smiling have a goal of eliciting caregiving responses from the mother, therefore creating a reciprocal response and dynamic between them. Although some of these behaviours could coexist with feeding, some are not oral in nature and could not be reduced in simple nutritional

²¹³ John Bowlby, *The Nature of the Child's Tie to His Mother*, in "International Journal of Psycho-Analysis", 39 (1958), pp. 350–373.

²¹⁴ Ibidem.

needs. Over the course of development, these behaviours become increasingly integrated together and focused on a single attachment figure, forming what he termed “attachment behaviour”.²¹⁵

Attachment and dependence, however, in his view could but should not be treated as equivalent. An infant may be biologically dependent on a caregiver for survival, but attachment arises from separate dynamic processes that center around the proximity to the caregiver, regardless of intimate physiological needs and their satisfaction. Both attachment and detachment are psychological processes that cannot be reduced to the degree of which physiological needs are met at a given moment.²¹⁶

By conceptualizing attachment as a behavioral system, rather than secondary reinforcement through feeding, Bowlby provided a framework that later received empirical support from experimental researchers and demonstrated how crucial contact and comfort are in the formation of early bonds.²¹⁷

Harley Harlow’s opinion on the topic was that psychologists failed to analyze love scientifically, partly because it was deemed too subjective for experimental investigation. In his view, feeding could not adequately explain the emotional quality of the attachment that develops between a mother and her infant and how strong and persistent it is.²¹⁸

Therefore, in an effort to give a contribution in answering this question, came his classic experiment with infant rhesus monkeys, since their developmental processes of clinging and nursing resemble those of human infants closely, but their faster maturation allowed

²¹⁵ Ibidem.

²¹⁶ Ibidem.

²¹⁷ Ibidem.

²¹⁸ Harlow, *The Nature of Love*, op.cit.

a controlled and precise observation within a more reasonable time frame. In a series of experiments for examining exactly how early bonds vary under different conditions and with who they form, Harlow and his team constructed surrogate mothers, one that was notably rigid and made from wires, while the other was covered with soft cloth provided contact comfort and warmth. The cloth surface was not a random choice, it was designed to simulate the softness and tactile qualities of fur or skin, which allowed to examine if and to what degree warmth and physical comfort functioned as independent motivation. For half the infant monkeys, cloth mother provided milk and for the other half wire mother did, so any preference in these cases could not be dismissed as infants simply choosing a food source.²¹⁹

Across their development paths, infant monkeys spent overwhelmingly more time clinging on the cloth mother, independent on if the wire or the cloth mother was the one lactating and providing them milk. The monkeys that were fed by the wire surrogate mother shifted from her and toward the nonlactating cloth surrogate mother over time. This was a direct contradiction to the idea of the time mentioned, that attachment is a secondary drive learned through the infant's pursuit of reducing their hunger.²²⁰

In another experiment, Harlow demonstrated that this preference for warmth and contact functioned as a true attachment bond under stress. When a stimuli meant to illicit fear (a moving toy bear) was introduced in the presence of both mother surrogates, infant sought out to the cloth mother and in situations when they were placed in rooms with many different kinds of stimuli, the infants clung to their cloth mother, alternating bursts of

²¹⁹ Ibidem.

²²⁰ Ibidem.

exploration with returns to the cloth mother before venturing out again. When the cloth mother was absent in these conditions, or when only the wire mother was present, infant monkeys demonstrated very distressed behaviors: freezing, crouching, vocalizing, rocking with high overall emotionality scores. Soft contact served a purpose much higher than monkeys simply feeling good and comfortable, it helped them reduce fear enough to allow for exploration and organizing their behavior better.²²¹

A natural follow up to these experiments was also to quantify this preference beyond just clinging time, and to do this Harlow adapted Butler's curiosity apparatus into a baby "love machine", with infant monkeys being given a choice to open a door to view different stimuli. Infants raised with surrogates responded to the cloth mother, but showed no larger interest in the wire mother than in an empty box, a huge demonstration that they were not attached to a "nursing machine", but the qualities that emit warmth and security. To conclude this series of experiments, infants were then separated from their surrogate mothers for up to 170 days, and continued to show a strong preference to their cloth mother on retention tests across different months, in exploration experiments the access to the cloth mother remained blocked since it was placed under a clear plexiglass cover, but the mere presence of the cloth mother still reduced stress in these infant monkeys. It seems that warmth operates both through direct and tactile soothing, as well as through how much infants perceive they are safe and if they have their expectations of comfort.²²²

These experimental observations circle back to Bowlby's theoretical framework. In discussion of the developmental responsiveness to the maternal figure, Harlow referred to

²²¹ Ibidem.

²²² Ibidem.

Bowlby's concept of "primary object following" and emphasized that infant orientation towards their caregiver, particularly the face of the mother, increases over the first weeks of the infant's life as the figure becomes especially significant. Harley gives examples of observations of infant monkeys showing initially little or no interest in facial features of the surrogate, but developed responsiveness as they got older and older, so we can conclude it is a developmental process that's shaped by both maturation and experience.²²³

A case involving a simplified surrogate mother figure who had was a smooth sphere and the infant monkey exposed to a blank face surrogate for months before encountering a more complex cloth mother, showed that in this context early familiarity played a bigger role for attachment than visual similarity and realism. When the monkey was presented with cloth mother with painted facial features, the monkey manipulated the head so only a smooth face with no visible features was visible, this action even reaching a degree of the monkey removing the head entirely and rolling it in the cage. Its behavior was not accompanied by any signs of distressed or possible fear, just goal-directed behavior and persistence the monkey had to give the head the sensory qualities it already associated with comfort. This finding, although unexpected, served as a challenge for assumptions that attachment would be guided by perceptual cues already deemed as biologically meaningful, for example facial configuration, and suggested that attachment could be shaped through prior contact experience the infant had and affective value of the

²²³ Ibidem.

caregiver, which was more important than the visual or physical characteristics of the caregiver.²²⁴

Interest in early childhood relationships grew and intensified during the late nineteenth and early twentieth centuries. The work of Mary Ainsworth emerged and with time, she became a central figure in attachment research, contributing to methodological innovations, such as the “Strange Situation Procedure”, and also theoretical concepts about the balance between exploration and security. Part of these theoretical contributions could be traced back to her academic training under William Blatz, whose ideas she encountered as his student.²²⁵

Blatz’s perspective developed independently, but within a similar context to that of Bowlby, and emphasized the significance of early relationships in fostering psychological security. Both Blatz and Bowlby had the mission of understanding how disruptions in early caregiving environments might influence adjustment long-term and although the two never met, Ainsworth brought her framework shaped by Blatz’s theory on security when she began her collaboration with Bowlby in 1950.²²⁶

Influenced by the psychoanalytic thinking ideas of the time, Blatz proposed in his earlier works that behavior itself was organized around cycles of needs, or how he called them “appetites”, that require satisfaction. These “appetites” could be compared to “drives” in psychoanalysis, however they weren’t derived from a libidal energy source and Blatz himself rejected the notion of unconscious mental processes being central in explaining

²²⁴ Ibidem.

²²⁵ Lenette van Rosmalen, *From Security to Attachment: Mary Ainsworth’s Contribution to Attachment Theory*, Leiden University, Leiden 2015.

²²⁶ Ibidem.

desires and ideas. His original concept “appetite of change” motivated exploration activities, through which children acquire experience and competence, and this process was understood to foster further development of psychological security.²²⁷

Security, according to Blatz, “may be defined as the state of consciousness which accompanies a willingness to accept the consequences of one’s decisions and actions.”²²⁸

Within his framework, security does not emerge from the absence of threat, it emerges from capacity to confront challenges. Individuals may experience security in two ways, through dependence on an external agent or through their own competence. For infants, dependent security is the dominating one, since the caregiver takes on the responsibility for protecting the child to act freely without fully experiencing risk or consequences, therefore this creates a subjective sense of stability for the infant. However, such dependence is fragile, since it relies on the availability and reliability of the “protective agent”. Any disruption, such as separation or loss, can lead to insecurity, and therefore require for individual to reorganize their behaviour to adapt to new circumstances that occurred.²²⁹

The movement toward independent security was considered to be a process that unfolded with development and was grounded in learning and experience. Individuals could achieve greater autonomy by gradually confronting situations for which they are initially unprepared. In this way, they can acquire skills through effort and persistence, and even though this process is quite emotionally charged because insecurity generates worry of

²²⁷ Ibidem.

²²⁸ William E. Blatz, *Understanding the Young Child*, Clarke, Irwin & Company, Toronto 1944, p. 165.

²²⁹ Ivi.

what needs to be overcome, exactly this serves as a challenge that promotes growth. Independent security is never fully complete and remains a process that continues throughout life, with each new experience revealing challenges that require us to learn and improve. Parental attitudes play a decisive role in shaping how the child moves from depending on them, if it approaches unfamiliar situations constructively or if they retreat towards dependence. In this way, security does not emerge from constant protection, but from the individual gradually building a sense of personal capability.²³⁰

Theoretical perspectives on the development of security within early caregiver and child relationship were later explored through empirical research. A huge contribution came from Mary Ainsworth, whose work in Uganda in the mid 1950s was the beginning of her exploration of separation and attachment. Ainsworth initially planned to investigate infants' responses to separation from their mothers so they can stay with their grandmothers instead. The idea of this separation was to facilitate weaning, but she later decided to adapt her focus when she observed that these traditional customs were no longer widely present.²³¹

Her research in Uganda involved a longitudinal observation of 26 families with unweaned infants aged between 1 month to 24 months. Each family was visited every two weeks for two hours on average. This observation lasted for nine months and took place in their homes, with Ainsworth's focus being to identify the development of signals promoting proximity, and to document a point at which these behaviours became directed towards the mother. The resulting data from this study served as a source for examining the quality

²³⁰ Ibidem.

²³¹ Van Rosmalen, *From Security to Attachment*, op.cit.

in mother-infant interactions, which was an area previously set aside by Bowlby since it carried methodological challenges for the time.²³²

Of particular importance was Ainsworth's early evaluation of maternal responsiveness to the signals their infants gave, which anticipated her later conceptualization of maternal sensitivity. After leaving Uganda and relocating to Baltimore, the analysis of her collected Uganda data was postponed, but the insights gained in this period laid the basis for a more systematic examination of attachment and maternal sensitivity that would follow.²³³

The Maternal Sensitivity Scales developed within the Baltimore study describe caregiving behavior across four dimensions: sensitivity to the child's signals, cooperation with the child's activity, acceptance of the child's age-related needs and the physical and psychological accessibility of the caregiver. These qualities are not treated as independent traits, but conceptualized as processes that emerge through caregiver-child interactions and are interconnected. Each scale includes a component that explains and describes how it manifests in natural interactions, together with guidance on the challenges in observing and interpreting behavior at this level of detail. Ratings were based on patterns of behavior, not isolated situations and actions, which is consistent with Ainsworth's work and emphasis on observation.²³⁴

The discussion of maternal sensitivity naturally extends to the question of how responsive caregiving could shape the child's engagement with environment. Sensitivity does not

²³² Inge Bretherton, *The Origins of Attachment Theory: John Bowlby and Mary Ainsworth*, in "Developmental Psychology", 28 (1992), pp. 759–775.

²³³ Ibidem.

²³⁴ Everett Waters, Inge Bretherton, Brian E. Vaughn, *Preface (2015)*, in Mary D. Salter Ainsworth, Mary C. Blehar, Everett Waters, Sally N. Wall, *Patterns of Attachment: A Psychological Study of the Strange Situation*, Psychology Press, New York 2015.

operate only in those moments of regulation of distress, but also influences the expectations of the child about the availability of support and whether exploration is deemed as manageable or threatening. The caregiver, therefore, takes on an important role to act as a “home base”, which allows the child to move outward and interact with the world while simultaneously maintaining access to reassurance when anxiety may exceed levels manageable for a child, a dynamic previously captured in Blatz’s conceptualization of security in parents-children relationships. When this relationship is experienced as insecure or unreliable, exploration becomes too risky and leads the child to always seek close proximity to the caregiver, which limits engagement with environment.²³⁵

Evidence that supports this formulation was also found in the Uganda study, where infants who showed more secure qualities in their attachment to the caregiver explored the environment actively in their mother’s presence, but displayed distress and interruption of their exploration activities when she was no longer there. In contrast, infants who showed more anxious qualities regarding their attachment to the caregiver showed efforts in remaining in proximity to their mothers and showed reduced exploration even when the mother remained present. However, later longitudinal observations of Baltimore infants suggested that the kind of environment also plays a role, within familiar environments, most infants initiated exploration, however the differences in attachment behaviours became more apparent under unfamiliar conditions.²³⁶

²³⁵ Mary D. Salter Ainsworth, Mary C. Blehar, Everett Waters, Sally Wall, *Patterns of Attachment: A Psychological Study of the Strange Situation*, Lawrence Erlbaum Associates, Hillsdale, NJ 1978.

²³⁶ Ibidem.

Since the concept of unfamiliarity suggested differences in infant's explorations and seemed to activate attachment needs more strongly than familiar settings do, the next route to take was to examine infant's behavior in situations that involved novelty or even mild stress. This logic was consistent with previously mentioned experimental work by Harlow and his experiments that involved rhesus monkeys being placed in new situations in the company of the warm cloth surrogate mothers, ultimately leading to the development of a structured procedure: the "Strange Situation".²³⁷

The Strange Situation Procedure is a structured assessment that was designed to observe infant attachment behaviours under new conditions that gradually increase stress. It consists of eight standardized episodes in a fixed sequence, starting with a condition that's meant to induce the least amount of stress and ending with more challenging situations. Initially, the infant and the mother are placed in an unfamiliar, but nonthreatening environment, containing toys, which is meant to allow the exploration of the infant in their caregiver's presence. A stranger then enters and approaches the infant gradually, after which the mother leaves the room and then returns and re-engages with the child in play. A second separation happens when the infant is left alone before the stranger returns, after which the mother returns again. This sequence is meant to activate the attachment system in a way that makes it possible to observe responses to distress as well as behavior upon reunion.²³⁸

The sample used consisted of 106 infants from families in the Baltimore area, distributed in four subsamples. Some infants had previously been observed in home environments

²³⁷ Ibidem.

²³⁸ Ibidem.

prior to the Strange Situation assessment, whereas others had minimal preparatory contact before the procedure, but for all of them the Strange Situation represented their first laboratory visit.²³⁹

The measures in the experiment were focused primary on visual orientation and exploratory behaviour, with the goal to capture how infants distribute their attention. Exploratory locomotion measured and referred to movement directed towards toys or other objects of the environment, excluding those movements associated with avoidance or distress. Exploratory manipulation referred to hand movement directed toward objects in exploratory manner. Visual exploration assessed attention directed to the environment and not to the people or objects associated with the caregiver, while in contrast, visual orientation measured looking towards the mother or the stranger, which made it possible to evaluate how infants distributed their attention across both social and non-social stimuli. The measures provided a framework that was structured in a way that made comparison across episodes and participants easier, while also serving as an empirical base for the classification of attachment patterns that was yet to come.²⁴⁰

Across all the episodes, the behaviours of infants changed quite systematically as their stress increased. In the initial phases, when the mother was present and the environment was new, but not yet challenging, most infants showed interest in their surroundings and engaged in exploration. In these phases the caregiver was used as a point of reference through looks or proximity. The introduction of the stranger, however, resulted in more variability in their responses, with some infants continuing their activity and others

²³⁹ Ibidem.

²⁴⁰ Ibidem.

showing hesitation or wariness. Separation episodes elicited clear responses related to their attachment, including reduced exploration and distress, searching behavior, orientation towards the exit and proximity seeking. Reunion episodes showed even more variability, as infants differed in how they approach, contacted or even avoided their caregiver, further highlighting their individual differences in attachment behaviors.²⁴¹

The highest level of exploratory behavior was reached when the caregiver was present and it continued to decline in her absence, with crying and searching behavior increasing during separations. Interactive behaviors also depended on who was present and shifted accordingly, with infants showing more positive social signals when their mother was available. Patterns of resistance and avoidance showed differences in how infants managed their emotional regulation under stress. Resistant responses were often showed in the difficulty of being comforted or in ambivalent approaches to contact, whereas avoidant tendencies could involve limited bids of interaction towards the caregiver despite the stressful situation. Smiling and vocalizing, as well as looking behaviours varied, with infants regulating their social engagement according to the security they perceived and familiarity, depending on if the interaction was directed towards the caregiver or the stranger. These behavioural shifts showed the impact of situation stress on infants and differences in how infants organize their strategies for maintaining security when faced with separation.²⁴²

In order to capture all of the patterns of behaviour and attachment that were observed, a classification system was developed, with the idea being organizing the behaviours

²⁴¹ Ibidem.

²⁴² Ibidem.

displayed through all the separations and reunions and the focus being to find patterns of strategies rather than to isolate reaction within individual moments. The dimensions previously mentioned were considered and then used to assign infants in three primary groups: A, B and C.²⁴³

Group A was classified as the avoidant group and characterized by an absence of proximity seeking behaviour, particularly during reunion episodes. These infants were often focused on the environment and continued to explore it even after the caregiver returned, ignoring bids for contact and maintaining distance. Although some sign of distress was expected during separation, their reunion behaviour seemingly tended to minimize attachment expression and suggested the development of a strategy in which the needs for proximity were downplayed instead of showed. When contact did occur, it was brief and it often lacked emotional engagement, with constrained and inhibited interaction, altogether reflecting a rather organized way of minimizing the expression of attachment needs in interactions in which proximity seeking has not consistently led to soothing and comfort.²⁴⁴

Group B was classified as the secure group and characterized by a flexible regulation of proximity and exploration across all episodes. With the mother present, these infants used her as a point of reference during exploration, which suggests their confidence in her availability. Interruption of activity and mild distress occurred during separation, but during reunion they tended to seek proximity actively and initiated contact, calming down when contact was achieved. After this reassurance, many infants returned to exploration

²⁴³ Ibidem.

²⁴⁴ Ibidem.

and their emotional expression was open and adapted to situational demands. Security was reflected less in how intense their emotional reaction during separation was and more in the infant's confidence that proximity to the caregiver would lead to comfort and emotional recovery. This pattern was understood as the most optimal one, with the infant demonstrating this confidence in the caregiver and open demonstration of attachment needs.²⁴⁵

Group C was classified as resistant or ambivalent and showed a pattern of heightened attachment activation, but with difficulty achieving comfort. These infants also displayed proximity seeking behavior upon reunion, but simultaneously demonstrated resistance, such as pushing away or showing anger while being held. Contact did not reliably reduce distress and calming occurred more slowly than in securely attached infants. Further exploration in the presence of the caregiver was limited with a focus on maintaining proximity instead of engaging with the environment. Their behavioural patterns were interpreted as reflecting uncertainty about caregiver's responsiveness and a tension between seeking closeness and expressing frustration, resulting in an attachment style with ambivalent responses to contact.²⁴⁶

Further analysis comparing behavior in the Strange Situation with observations already collected in the home environment showed that patterns displayed were not situationally isolated, in fact they reflect some broader characteristics of the relationship between infants and mothers. Infants who were securely attached in the Strange Situation also displayed more balanced interactions at home, with greater ease in maintaining proximity

²⁴⁵ Ibidem.

²⁴⁶ Ibidem.

and more responsive exchanges with mothers. Infants who showed patterns other than secure, such as avoidant or ambivalent, showed differences in how they responded to separation and regulated distress also in everyday contexts, which suggested continuity between their behaviour in natural environment and laboratory observation. Children classified as avoidant appeared relatively independent and less distressed during separations. Children classified as resistant or ambivalent at one year showed heightened dependency and difficulties with emotional regulation across contexts. In home or everyday environments, they were more likely to display clinginess and difficulty being soothed, similar to behavior observed during reunion episodes in Strange Situation. Examination across different period of the first year also supported this association, with infant behavior during earlier and later home observations both related to Strange Situation behaviors, indicating how these differences in attachment behaviors emerged gradually and over time. Crying, following, greeting, contact-seeking with the caregiver and overall responsiveness reflects how infants used their caregivers as a source of security in daily interactions and situations.²⁴⁷

Therefore, we can conclude that these findings did a good job in capturing the attachment patterns that had already developed within ongoing interactions and provided solid evidence that the laboratory assessment corresponded to real behaviour in ordinary situations observed across the first year.

The introduction of a fourth category in the classification came years later and emerged from observations that the traditional system did not capture all the possible patterns of infant behavior that could occur in the Strange Situation. Reported difficulties in

²⁴⁷ Ibidem.

assigning certain infants into existing A, B or C categories were leading into infants being categorized into the best fitting category, although that category did not accurately represent responses that appeared inconsistent and lacked clear organization.²⁴⁸

Evidence from studies involving high-risk populations, particularly those infants that were exposed to abuse or neglect, played a critical role in expanding the existing attachment classification system. A proportion of maltreated infants were categorized as secure despite experiences that should predict insecurity and because the secure pattern was assumed to depend on a history of a secure and responsive relationship with the caregiver, more re-examination was needed in order to understand and categorize these differences. This led researchers to identify new subgroups, some consisting of infants who appeared anxiously attached yet did not conform to classic avoidant or resistant patterns and rather showed apathetic and atypical behaviours. To capture behaviours that reflected this inconsistencies in the infant's approaches in managing attachment-related stress, a new category was introduced: disorganized/disoriented attachment.²⁴⁹

Disorganized attachment category is characterized by behaviors that appear fragmented and contradictory, especially in the presence of the caregiver. Infants under this category did not show a consistent strategy for achieving proximity or comfort and instead showed visible disruptions in their attachment behavior. Examples included approaching the caregiver while averting their head, freezing, initiating movements toward the caregiver and then suddenly stopping or even showing stereotyped or repetitive movements. These

²⁴⁸ Mary Main, Judith Solomon, *Procedures for Identifying Infants as Disorganized/Disoriented during the Ainsworth Strange Situation*, in M. T. Greenberg, D. Cicchetti, E. M. Cummings (eds.), *Attachment in the Preschool Years: Theory, Research, and Intervention*, University of Chicago Press, Chicago 1990.

²⁴⁹ Ibidem.

behaviours were interpreted as reflecting a conflict in the attachment system where the caregiver was possibly seen as a figure that represents both a source of fear and a source of comfort. Importantly, although disorganized attachment was observed frequently among infants from neglectful and abusive backgrounds, the classification itself is descriptive and not diagnostic, the terms disorganized and disoriented were not intended to represent indicators of psychopathology. They were intended to refer to the form of attachment behaviour that was observed and that may be expressed in different ways across individuals.²⁵⁰

Across the theoretical and empirical evidence and developments reviewed in this chapter, the work of Bowlby and Ainsworth emerges as particularly striking in combining the theoretical framework with detailed observational evidence concerning early relationships. The convergence between Bowlby's theoretical model and Ainsworth's finding highlights the role of caregiving experiences in shaping individual differences in attachment organization. The attachment relationship, as we discussed, provides a context within which infants organize expectations and engage in communicative exchanges. From this point, it would seem reasonable to consider that such early experiences and patterns could also be relevant for cognitive development. Infants are continuously exposed to environments full of signals and stimuli, having many opportunities to interpret meaning. Therefore, consideration of attachment processes could provide valuable information for examining how these early experiences influence communicative environments in which children require language, as well as those cognitive structures that support learning from said environments.

²⁵⁰ Ibidem.

3.2. The Interplay Between Attachment, Cognition and Early Communication

A central challenge in developmental theory concerns how exactly these early relational experiences influence later social understanding and behavior. Attachment research has demonstrated that infants show individual differences in how they respond to their caregiver. However, explaining how exactly these differences persist across contexts, how they influence the child's expectation and development, as well as what possible effects could they have on the child's future life and functioning, requires examining underlying psychological processes.

Bowlby proposed that children construct "internal working models" of relationships based on repeated interactions with caregivers. In this way, past experiences provide information better form expectations about future encounters. Rather than referring to static memories, Bowlby took a more dynamic approach, proposing that this term emphasizes dynamic mental processes that guide how an individual interprets events and anticipates the future, organizing its own actions accordingly.²⁵¹

Following theoretical developments in cognitive psychology provided support for this idea and proposed that these representations of repeated experiences are organized into schematic structures that summarize all the essential information about past interactions that happened over time. For example, studies of story recall indicate that young children rely on schematic expectation about the typical sequence of events when constructing

²⁵¹ Inge Bretherton, Doreen Ridgeway, Jude Cassidy, *Assessing Internal Working Models of the Attachment Relationship: An Attachment Story Completion Task for 3-Year-Olds*, in M. T. Greenberg, D. Cicchetti, E. M. Cummings (eds.), *Attachment in the Preschool Years: Theory, Research, and Intervention*, University of Chicago Press, Chicago 1990.

their own narratives and in this way prior knowledge organized both memory and interpretation.²⁵²

The notion that individuals construct their own internal representations capable of simulating relational events can be traced back to Kenneth Craik, who proposed that we develop internal models of reality that later allow us to anticipate the future. These models we use to make assumptions on what the consequences of our actions will be in the future, which then becomes useful for organizing our actions in the present. Craik's models are not just passive representations about our past, he describes them as tools that we use to take action, which have a purpose of guiding our behaviors efficiently in environments that are more complex or often not familiar. The power of anticipation in his view lays in the fact that we could adapt to situations even before they occur.²⁵³

From this perspective, we can understand Bowlby's internal working models as kinds of "relational scripts" that are derived from repeating exchanges between children and their caregivers, capturing expectations about how interactions typically unfold and what outcomes they usually lead to. So, the function of prediction of events in Craik's internal models of reality we can connect to the function of expectation about caregiver availability in the Bowlby's internal working models; the end goal of simulation before action in Craik's model becomes comparable to behavioral regulation in attachment contexts and situations in Bowlby's model; and the representations based on experience

²⁵² Jean M. Mandler, Marsha DeForest, *Is There More than One Way to Recall a Story?*, in "Child Development", 50 (1979), pp. 886–889.

²⁵³ Kenneth J. W. Craik, *The Nature of Explanation*, Cambridge University Press, Cambridge 1943.

in Craik's model are similar to Bowlby's idea of representations, only Bowlby's were more relationship-specific.²⁵⁴

Bowlby's approach to attachment was that it functions as a system directed toward a goal deemed biologically meaningful: to maintain proximity to a protective caregiver. Behaviour is continuously shaped by information coming from the environment, as well as coming from the condition of the individual in said moment, so the child could adjust to the changing circumstances accordingly.²⁵⁵

Repeated interactions with a caregiver gradually provide a basis for expectations about said caregiver, if they will be available and responsive towards the child, so the attachment behavior in this way reflects accumulated relational experience and not the immediate situation on its own.²⁵⁶

Emotional experience is equally important in this regulatory process. with feelings such as anxiety, distress and confidence emerging in the child as a result of the child's appraisal and the caregiver's confidence. Feelings emerge as indicators of how situations are interpreted and emotional reactions reflect ongoing processes of interpretation that further link experience with action. Because these appraisals are informed by prior interactions, children are able to anticipate what's the most likely scenario of how their attachment figures will behave, and such expectations not only change the behavioral choices, but also emotional reactions. Over time, attachment relationships contribute to the development of those internal representations that later organize how we perceive and

²⁵⁴ Craik, *The Nature of Explanation*; John Bowlby, *Attachment and Loss*, Vol. 1, *Attachment*, Basic Books, New York 1969.

²⁵⁵ Bowlby, *Attachment and Loss*.

²⁵⁶ Ibidem.

interpret social situations, and in this way link affective experiences with patterns of interaction.²⁵⁷

Emotional expression, according to Bowlby, serves as a very important communicative task in social interactions, since it carries information about the individual's internal condition and needs to other people. Emotions function as a signaling system through which individuals share parts of their internal world and could potentially influence the behaviours of other people. These processes could operate even prior to the development of speech and serve as a form of symbolic communication and unlike other species, humans are able to respond not only to those stimuli they perceive directly, but also to information delivered in a symbolic way, through words.²⁵⁸

The ability to communicate internal states through language represents a big developmental achievement that appears from earlier interpersonal exchanges. Understanding how children move from these prelinguistic signals to the use of words is therefore a valuable question to answer, addressed from both cognitive and social perspectives.

Piaget's theory of cognitive development could provide important information in regard to understanding how early forms of communication may gradually develop into symbolic language. According to him, intelligence does not emerge suddenly, but develops in a progressive way from sensorimotor activity during infancy.²⁵⁹

²⁵⁷ Ibidem.

²⁵⁸ Ibidem.

²⁵⁹ Jean Piaget, *The Origins of Intelligence in Children*, trans. Margaret Cook, International Universities Press, New York 1952.

His concepts of assimilation and accommodation are particularly important in cognitive development. By the term assimilation, he referred the incorporation of new experiences into existing cognitive structures, in this way the child can interpret input from the environment in terms of schemas it previously established. In contrast, accommodation refers to the modification of these schemas in order to be able to respond to environmental demands. Development, therefore, surfaces through a balance between these two processes, as cognitive structures are constantly reorganized in response to the environment.²⁶⁰

Piaget's theory of cognitive development is centered around the sensorimotor period which last for about two years. He proposed that verbal intelligence develops from practical (or sensorimotor) intelligence. During the earliest phase of the sensorimotor period, infant's behaviour is guided by innate reflexes, for example sucking and grasping, and it is through repeated interaction with objects and other people that this reflex activity becomes differentiated and structured into behavioural patterns that are more complex. The second phase of sensorimotor development is characterized by the early emergence of primary circular reactions, centered around infant's own body and reproduced and repeated because they lead to pleasurable effects. Examples of these behaviours include thumb sucking or repetitive hand movements. Circular reactions are active processes, as the infant engages in experimentation with body movements repeatedly, leading to those body movements becoming more coordinated and controlled. They are an excellent example of previously mentioned processes of assimilation and adaptation, since they

²⁶⁰ Ibidem.

extend existing reflexes while generating new coordinations that were not originally present in the reflex mechanisms.²⁶¹

A developmental shift occurs with the emergence of secondary circular actions, during which infants begin to direct their own actions towards objects and events rather than only towards their own bodies. Behaviour becomes oriented toward producing and maintaining interesting effects in the environment in this stage, such as shaking a toy to make a sound or a movement. These actions are also the beginning of intentionality and Piaget views this as a turning point in development, with infants moving from a mostly self-centered world towards the construction of a more objective reality. The fourth stage then introduces the coordination of secondary schemata and represents a very clear emergence of goal-directed behaviour. Infants are now able to combine previously learned actions in an intentional way to achieve the outcomes they desire. This period is also associated with some early forms of object permanence, since infants in this phase begin searching for hidden objects and recognize that the objects continue to exist even when they may not be perceived²⁶²

Object concept or object permanence here refers to the child's developing understanding that objects continue to exist, even when the child does not directly see them at the moment, for example when they are out of sight or hidden. Early in life, infants believe objects disappear when they are out of sight but with time they gradually begin to search for hidden objects, which suggests that they begin to gain awareness that something continues to exist even when it is not visible. The progression into the mental

²⁶¹ Ibidem.

²⁶² Ibidem.

representations independent of immediate perception reflects their new capacity of not relying on direct sensory input and the appearance of a first stable structure of thought.²⁶³

To parallel, Bowlby considered the development of attachment behaviour to partly depend on the infant's capacity to form internal representations of objects (and people), a process conceptually similar to Piaget's object permanence. From his view, the infant's ability to make and maintain a mental representation of their caregiver in their absence later allows attachment behaviours of seeking proximity and protesting separation to become goal-directed and well-organized. The relationship between cognitive maturation and attachment is not about one preceding the other, but about attachment interactions themselves providing experiences that then support the ongoing development of cognitive capacities, such as representational capacity. In this way, Bowlby's and Piaget's ideas could be connected and reflect a two-way association between cognitive maturation and relational experiences.²⁶⁴

Tertiary circular reactions appear in the fifth stage, in which the infants experiment actively with new possibilities and vary their actions to observe new outcomes. This phase suggests the development of exploratory problem-solving behaviours, as children actively investigate the properties of objects and casual relationships with environment. Exploratory behaviours contribute to the expansion of cognitive representations and also prepare the groundwork needed for more advanced forms of reasoning that will follow.²⁶⁵

²⁶³ Ibidem.

²⁶⁴ Elizabeth Meins, *Security of Attachment and the Social Development of Cognition*, Psychology Press, Hove, UK 1997.

²⁶⁵ Piaget, *The Origins of Intelligence in Children*, op.cit.

The culmination of sensorimotor development happens in the sixth stage and in this stage the infants acquire capacity for mental representation. They can mentally simulate actions at this point, even without performing them directly, and demonstrate their ability to form internal representations of objects that are absent or events that are not happening in the given moment. This is reflected in behaviours such as symbolic play and imitation, also in the mental reconstruction of problem-solving sequences. Piaget considered this stage to be the completion of sensorimotor intelligence and the beginning of transition toward the symbolic thought, as mental representations prepare the cognitive foundation that is necessary for language acquisition. A good example for this would be the ability to bring to mind an absent object mentally, which then allows words to function as symbols and refer to things or states that are not immediately present, by such means enabling the appearance of linguistic communication.²⁶⁶

Piaget extends his analysis of early cognitive development to the domain of language more specifically in the following years, examining how children's speech reflects the underlying organization of their thought. One of his central claims remains that language expresses cognitive structures, so changes in linguistic behaviour are linked to transformation in underlying processes.²⁶⁷

Early forms of speech are closely tied to the child's experience and provide insight into the child's cognitive perspective, which Piaget characterized initially as egocentric. The term "egocentric" in this sense does not refer to selfishness, it refers to limited differentiation of personal point of view and point of view of others, since children often

²⁶⁶ Ibidem.

²⁶⁷ Jean Piaget, *The Language and Thought of the Child*, trans. Marjorie Gabain, Harcourt, Brace & Company, New York 1926.

speak without even fully considering whether the listener has the same information or the same perspective as them. There is a distinction between egocentric speech and socialized speech, as Piaget proposed, since a great proportion of young children's verbalization complete functions that are related to their own activity and not so much to a communicative exchange with another person.²⁶⁸

Egocentric speech includes forms of repetition, monologues and collective monologues, in which children talk in parallel and without actually coordinating meaning with others. In his view, these patterns show how dominant individual cognitive activity is in this period over social adaptations, since as children mature, speech becomes increasingly oriented toward initiating and maintaining communication, with a greater focus on shared understanding. This shift shows broader cognitive changes the child is experiencing, especially the growing capacity for decentration and logical reasoning.²⁶⁹

Notably, Piaget didn't deny that social interaction has a role in linguistic development, he considered that social communication becomes more effective as cognitive structures mature. His view was that interactions with other people contribute to development by creating more opportunities for a conflict between perspectives to emerge, which should encourage the child to reorganize its thought. Therefore, language is seen less as an influence of cognition and more as an expression of it. This theoretical position contrasts with later perspectives, especially those that give a more important role to social interaction and communicative exchange in shaping cognitive and linguistic development, not the other way around. The leading contrasting position came from Lev

²⁶⁸ Ibidem.

²⁶⁹ Ibidem.

Semyonovich Vygotsky, whose sociocultural approach proposes that cognitive development cannot be understood independently of interpersonal contexts in which it appears, so language according to him is not just an expression of thought, but also a psychological tool that serves as a mediator for mental activity and transforms the structuring and the organizing of behaviour.²⁷⁰

A central premise of Vygotsky's viewpoint is that higher psychological processes emerge through socially mediated activity, he argues that cognition in humans is shaped by culturally established tools. A crucial transformation in development occurs when language, a tool usually used for communicating with others, becomes incorporated into the child's problem-solving behaviour.²⁷¹

In Vygotsky's own formulation: "the most significant moment in the course of intellectual development, which gives birth to the purely human forms of practical and abstract intelligence, occurs when speech a practical activity, two previously completely independent lines of development, converge."²⁷²

Observations of children engaging in goal-directed behaviour and tasks showed that speech doesn't just accompany activity, but also organizes and structures behaviour, guides attention and enables planning before an action could even be carried out. As tasks become more difficult or demands of the environment increase, verbal mediation become

²⁷⁰ Piaget, *The Language and Thought of the Child*; Lev S. Vygotsky, *Mind in Society: The Development of Higher Psychological Processes*, ed. Michael Cole et al., Harvard University Press, Cambridge, MA 1978.

²⁷¹ Vygotsky, *Mind in Society*.

²⁷² Ivi, p. 24.

more central and children use language to solve tasks similar to how they use their perception or their hands to solve them.²⁷³

Vygotsky's interpretation of egocentric speech contrasts with Piaget's interpretation that egocentric speech is a sign of cognitive immaturity that over time diminishes or disappears with the child's maturation and development. Instead, Vygotsky argues that this kind of speech becomes internalized and therefore it is able to directly affect the emergence of self-regulation and voluntary control. It is through this process that the interpersonal dialogue is transformed into personal functioning, which helps children plan their actions and inhibits more impulsive responses.²⁷⁴

The concept of internalization is explained as the central process through which socially mediated experiences are reshaped into psychological functions. Vygotsky first proposed a general law of cultural development, according to which every higher psychological function appears twice in the process of development and maturing, the first time it appears at the social level in interactions between individuals, and the second time it appears internalized on an individual level. This is not just a simple transformation of an activity from external to internal, instead it presents a more complex reconstruction of socially organized functioning, so it can become integrated into the child's own cognitive system. This could serve as a solid demonstration of the social nature of higher processes, since even those cognitive operations that may seem only individual retain the structures of social interactions from which they originated. Expanding his concept of internalization, Vygotsky proposed another concept, "the zone of proximal

²⁷³ *Ivi.*

²⁷⁴ *Ibidem.*

development”, to better explain how interactions with those of more knowledge promote cognitive growth.²⁷⁵

The zone of proximal development is defined as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.”²⁷⁶

In other words, we can understand the zone of proximal development as the distance between the child’s actual developmental level and the level of the child’s potential development, in cases where the child is solving a task under adult’s support or in cooperation with its peers. Proper understanding of cognitive growth, therefore, requires consideration of everything the child can accomplish under the guidance of others, not only what it can accomplish alone, so learning can serve as an active force that promotes developmental change by activating processes that may not be fully formed yet. Successful instruction targets those functions that are in the process of appearing and allows learning to lead development, and using the mechanism of imitation later, children could participate in activities that at the moment exceed their independent abilities.²⁷⁷

Considering Vygotsky’s description of development as surfacing through guided participation, we can connect to early child-caregiver interactions, since they present a primary context in which these processes could operate. If progress in development depends also on activities that the child performs without assistance before it can master

²⁷⁵ Ibidem.

²⁷⁶ Ivi, p. 86.

²⁷⁷ Ivi.

them independently, then interaction with knowledgeable adults could provide guidance and support necessary to perform the tasks beyond the child's current level.

More influential work comes from Elizabeth Meins , whose work adopts a framework similar to Vygotsky's, while also integrating the attachment theory. Her approach accepts the core concept of internal working models on self and others, based on early caregiver interactions and emphasized that these representations should be understood and examined in the context of broader processes of ego development and psychological organization, and they are not related to relationships only, since the child's develops a self-concept and their own stress responses based upon ongoing interaction with attachment figures. Therefore, the acceptance or rejection of the attachment figure do contribute to those internal representations that later guide expectations in future relationships like Bowlby thought, but they also influence the child's overall emotional functioning, as well as the development of child's resilience and coping mechanisms, so his concept has implications extending the attachment behaviour himself.²⁷⁸

Bowlby describes internal models as relatively stable once formed, while acknowledging that revision may occur. Meins elaborates this position with considering empirical findings that support the continuity but indicate the possibility of changes that could be expected when a child experiences repeatedly contradicting evidence to its expectations. Evidence from studies using the "Adult Attachment Interview" demonstrate a correspondence between parents' attachment representations with their infant's attachment classifications, supporting Bowlby's statements that internal working models may be transmitted across generations. However, Meins draws attention to "earned

²⁷⁸ Meins, *Security of Attachment and the Social Development of Cognition*, op.cit.

autonomous” individuals who achieve autonomous attachment representations, even though they grew up in non-optimal and adverse environments in childhood. The sole existence of these cases raised questions about the processes that allow some individuals to reorganize their existing representations and suggested that developmental pathways remain open to modifications to some extent. By later integrating a “Vygotskian” concept of internalization, she was able to offer potential explanations for both continuity and change, with psychological structures emerging through interactions and then reorganizing themselves as individuals participate in new relation contexts, implying that ongoing experiences may reshape the structures related to earlier relational experiences and psychological organization over time.²⁷⁹

Further drawing on Vygotsky's principle of zone of proximal development, her opinion is that different outcomes could also be understood in terms of how effectively the behaviour of the caregiver supports the child's engagement and learning. Patterns of early interactions between the mother and her child, such as guidance and responsiveness, as well as their overall communicative exchange, become internalized and guide the child's independent behaviour. These early experiences become influential for emotional and cognitive development and include scaffolding and support, which could later guide the child's autonomous functioning. The variability observed in developmental outcomes may therefore reflect differences in how early interactional experiences are organized and internalized, and this same internalization process continues across development, allowing for both continuity and modification.²⁸⁰

²⁷⁹ Ibidem.

²⁸⁰ Ibidem.

While attachment research has traditionally focused on social and emotional outcomes, above described processes of scaffolding and internalization are equally relevant for communicative development. In particular, language acquisition presents a domain in which the interaction between developmental processes and relational interactions could be examined in great detail. Early perspectives of language development were strongly influenced by Piaget's theory, which as discussed, explained linguistic processes as consequences of underlying cognitive structures and maturation. Language was viewed primarily as an expression of abilities that appeared during the late stages of the sensorimotor period, once children developed object permanence and symbolic thought, implying that advances in language demonstrate cognitive achievements already obtained. However, later empirical findings have challenged this viewpoint, with evidence that links early word learning to specific milestones in cognitive development proposing a more complex interaction between language and cognition.²⁸¹

Research examining the emergence of relational vocabulary has demonstrated that children may succeed in using words productively before their corresponding cognitive structures are showed in non-linguistic tasks, reconsidering the relationship between cognition and language using a phenomenon called "naming explosion". For example, in a longitudinal study about lexical acquisition, evidence showed that many children experience a period of a very rapid vocabulary growth, characterized by object labels and nouns, while other children demonstrated a gradual acquisition of new words with a more varied vocabulary, These findings point to the idea that early language development could follow different trajectories, seemingly not determined by an identical sequence based

²⁸¹ Ibidem.

only on cognitive maturation. Moreover, the association between word-learning and object-naming has been interpreted as possible evidence that acquiring linguistic labels for object may support later development, challenging views that language comes after cognitive achievements and acts only as a “consequence” of them.²⁸²

Children do not all approach language with the same hypothesis, that is, their opinions differ in what they believe language is “for”. Some children appear to treat language primarily as a tool to refer to object and events, understanding language as a system for describing the world and developing vocabularies that include a greater number of general labels and demonstrate faster vocabulary growth. Other children use language mainly within social interactions and exchanges, to them language is a tool for social interaction which includes personal expressions, specific phrases and routines. These patterns Katherine Nelson explained as “referential style” and “expressive style” and suggested that variability that is present between children could arise not only from differences in cognitive maturation, but also from differences in communicative orientation.²⁸³

Nelson’s analysis also suggests these differences are to a degree responsible for variations in caregiver’s input, with patterns of mother’s speech correlating with children’s linguistic profiles. Mothers of children with a “referential style” use language that is more object-focused, while mothers of children with an “expressive style” use language that is more socially oriented, with findings showing that development is

²⁸² Beverly A. Goldfield, J. Steven Reznick, *Early lexical acquisition: rate, content, and the vocabulary spurt*, in “Journal of Child Language”, 17 (1990), pp. 171–183.

²⁸³ Katherine Nelson, *Structure and strategy in learning to talk*, in “Monographs of the Society for Research in Child Development”, 38 (1–2), 1973.

facilitated when caregiver language style matches the language style of their child and mismatches leading to a slower progress.²⁸⁴

Having in mind the distinction between referential and expressive styles, an important question may arise concerning the factors that may influence why children adopt one pathway rather than another pathway. These styles reflect differences in both communicative orientation and autonomy, so the attachment theory could potentially provide answers, since as already argued, it represents the main framework for examining how caregiver-child relationships are associated with socioemotional outcomes and development of the cognitive structures and their developmental pathways.²⁸⁵

Empirical research directly linking the security of attachment to language acquisition has produced mixed findings. While some studies have reported no significant differences between securely and non-securely attached infants in vocabulary size or comprehension in their first year and suggested that attachment may not be directly linked to the quantity of language at these early stages, other studies showed evidence of potential variation and distinctions. For example, infants classified as securely attached showed more declarative pointing, a communicative behavior associated with both joint attention and intentional communication, which in turn predicts later attachment security. Additional examples from other studies of older infants demonstrated findings of securely attached infants showing linguistic abilities that are more advanced, including complex utterances and vocabularies of a larger capacity.²⁸⁶

²⁸⁴ Ibidem.

²⁸⁵ Meins, *Security of Attachment and the Social Development of Cognition*, op.cit.

²⁸⁶ Ibidem.

Importantly, it has to be considered that those results could be attributed also to other contextual factors, some discussed in Chapter 2, for example to socioeconomic risks. This gap in literature needed further examination in order to move beyond just qualitative measures of vocabulary and bring into consideration also the kind of influence relational experiences have, a gap that motivated Elizabeth Meins' further investigation. Meins concluded an empirical investigation focusing on acquisitional styles and attachment, the purpose of the study being to address the inconsistent evidence mentioned in the previous paragraph. With the theoretical assumptions of the time testing if attachment relationships may influence how much language children acquire, she was interested in the manner in which children engage in linguistic learning as well. Her idea was to determine whether securely and insecurely attached children showed differences in the extent to which their production reflected referential or expressive orientations, this including object naming, the use of routine expressions, the use of context-bound expressions and the balance within language between socially-directed or focused on the environment.²⁸⁷

The results revealed systematic differences between attachment groups. Securely attached children were more likely to display those characteristics that were associated with a referential communicative orientation, including more object labels in their vocabularies and patterns deemed consistent with a more rapid lexical growth. They also showed a lower dependence on "frozen" or routine phrases, therefore suggesting a greater level of flexibility in production and a tendency to create new utterances and not solely reproduce expressions already memorized. In contrast, insecurely attached children demonstrated characteristics associated with an expressive communicative orientation more frequently

²⁸⁷ Ibidem.

and showed a reduced emphasis on object naming. The differences were observed even when the overall vocabulary size was considered, this finding indicating that attachment security was related not simply to the quantity of the acquired language, but also the quality of the organization of language.²⁸⁸

A particularly interesting finding was that mothers of securely attached children less likely described the speech of their child as “vocal but meaningless”, this pattern can be interpreted less in the light of differences between children’s production and more in the light of the willingness of these mothers to understand and interpret the intention behind the child’s vocalization. This highlights the importance of the mother’s interpretative processes and suggests that examining in more detail how caregivers perceive, comprehend and respond to child’s vocalization and signals.²⁸⁹

Meins dedicated her following work to the relevance of caregivers’ tendencies to treat their infants as communicative agents, introducing the construct of “mind-mindedness” Mind-mindedness she defines as “the proclivity to treat one’s child as an individual with a mind from an early age.”²⁹⁰

The concept was introduced so she could capture differences in the ways caregivers attribute meaning to their children’s action and linguistic production, and it emerged partly in response to more limitations within existing cognitive development frameworks. Prior research has acknowledged the importance of early social interactions for the appearance of mentalizing abilities, but relatively little attention to this research area has

²⁸⁸ Ibidem.

²⁸⁹ Ibidem.

²⁹⁰ Elizabeth Meins, Charles Fernyhough, *Linguistic Acquisitional Style and Mentalising Development: The Role of Maternal Mind-Mindedness*, in “Cognitive Development”, 14 (1999), pp. 364

been given to how different caregivers are in these interaction. Theoretical views that took inspiration from Vygotsky, as debated, highlighted the process of internalization, while others highlighter the accumulation of knowledge about ours and other people's mental states.²⁹¹

This capacity to attribute mental states to others was initially examined in a study attempting to understand if it was a capacity shared between species or uniquely human. Premack and Woodruff proposed that an individual could be said to have a theory of mind when they are able to conclude psychological states that are not observable, such as intentions or beliefs for example, and use them to anticipate behaviour. To explore this question, they observed a chimpanzee presented with film scenarios that show a human encountering various obstacles and after each scene, a chimpanzee had to select an image that would be a potential solution to the human's problem. Successful problem solving meant that the animal would be able to represent the actor's goal and intention and account for the human's knowledge about how the problem might be resolved.²⁹²

The chimpanzee tended to choose contextually solid solutions, which was deemed as suggesting sensitivity and possible understanding of the human's point of view, the situation and the purposeful action. The authors then proposed that attributing intention and knowledge to another individual would allow the animal to make sense of the situation and choose an appropriate solution, in this way meeting the criteria of possessing at least a primal level of theory of mind. Alternative explanations of the results deemed his behaviour as based on learned associations and past experiences. From that

²⁹¹ Ivi, pp. 363–380.

²⁹² David Premack, Guy Woodruff, *Does the Chimpanzee Have a Theory of Mind?*, in "Behavioral and Brain Sciences", 1 (1978), pp. 515–526.

perspective, the chimpanzee might have recognized incomplete patterns of behaviour and simply selected the behaviour that best completed the sequence based on its acquired previous experience. A third interpretation of the findings explained the chimpanzee might not be reasoning the human's mental states, but predicting the human's behaviour based on imagining what it would do in a similar situation. This interpretation centers around empathic projection, with the main distinction between this one and the theory of mind explanation being that with empathic reasoning one may attribute a goal or purpose to another, but it does not require representing the beliefs or knowledge of another.²⁹³

The different possible explanations, according to authors, should not be treated as mutually exclusive. Associative learning could contribute to expectations in contexts that are familiar, and new situations may require processes of reasoning about mental states. Nonetheless, the study presented a novel framework for considering social cognition that took into account mental states rather than only behavioural prediction. This was the work that provided a foundational definition for the theory of mind, that has influenced research since.²⁹⁴

Mind-mindedness is particularly relevant in the context of understanding how theory of mind emerges, since children's capacity to attribute mental states to others may develop also through repeated experiences of their own behaviour being interpreted by caregivers. By treating infants as intentional communicative agents and partners, caregivers could potentially in this way scaffold children's awareness of internal states. Mind-mindedness, therefore, provides a way of conceptualizing and measuring how exactly the caregivers

²⁹³ Ibidem.

²⁹⁴ Ibidem.

attribute significance to their infant's behaviour and production from early developmental stages. Early vocalizations, for example, often don't resemble the conventional words and understanding these early vocalizations would require contextual information, knowledge of the gestures used or knowledge of the child's own knowledge. Recognizing these vocalizations as the child's attempt to convey meaning already involves the principle of attributing a communicative intent to an agent, therefore this would reflect mind-mindness.²⁹⁵

In this context, the study examined three factors: the continuity of maternal tendencies to attribute meanings to their infants' vocalizations, the relationship between these tendencies and their children's later understanding of the mental states and the extent to which the early linguistic acquisitional style predicts later mentalizing competence. The participants were drawn from the previously studied longitudinal cohort for which detailed early language data had already been collected during infancy, so it could be possible to link early communicative patterns with outcomes observed a couple years later. Maternal mind-mindness was evaluated through mother's own interpretations of their children's vocal productions and mothers were asked to indicate what they believed their infants were trying to convey when they were producing utterances, with their responses being coded according to whether or not they attributed them with intentional meaning.²⁹⁶

A longitudinal element was also theoretically important since it addresses the question of whether mind-mindness represents a characteristic that is stable across time or was it a

²⁹⁵ Meins, Fernyhough, *Linguistic Acquisitional Style and Mentalising Development*, op.cit.

²⁹⁶ Ibidem.

feature of the interaction happening at the moment. To assess it, later interactions between the mothers and their children were analyzed for references to mental states, allowing for the testing of tendencies that were observed in infancy in terms of whether they persisted across development.²⁹⁷

The results revealed that those mothers who were more likely to interpret their children's vocalizations during infancy as intentional, were more likely to refer explicitly to mental states during interactions with their children several years later. This supported the view that mind-mindedness reflects a relatively stable orientation towards the child and not just behaviour adapted to a particular interaction or developmental stage. Measures of mind-mindedness obtained during infancy were associated to a high degree with children's later performance on theory-of-mind tasks, indicating that these early caregiver interpretations may contribute to the development of mentalizing competence in the child. This association remained meaningful even with other variables considered, so the results support the hypothesis that children's understanding of mental states emerges partly through the experience of their own behaviour being interpreted. In contrast, children's linguistic acquisitional styles in this case did not demonstrate a predictive relationship with later mentalizing outcomes. Referential styles and expressive styles of learning, as we mentioned earlier, did demonstrate distinct approaches to early language learning, however these differences were not found significant for the theory of mind performance.²⁹⁸

²⁹⁷ Ibidem.

²⁹⁸ Ibidem.

An additional finding emerging from the language data concerned family composition. The number of older siblings was associated with differences in vocabulary content, with children who had more older siblings showed a lower proportion of object labels (or common nouns) and a higher reliance on “frozen” routinised expressions. Previous research had identified differences between first born and later born children, however the relationships with the actual number of siblings has not been examined previously.²⁹⁹

The influence of family context on early language therefore remained a central point in this area of research. A later longitudinal investigation, also conducted by Meins and colleagues, examined the connection between attachment and mental states. The study focused on infancy period that precedes language production, to better examine the direction of influence. By measuring maternal behaviour before children even possessed linguistic competence, the researchers were able to follow how early communicative environments contribute to cognitive outcomes, and to inspect whether early relationships and experiences, and not only conversational patterns, provide a base for the development of mental capacities. The results indicated that mothers’ appropriately attuned comments about mental states during infancy were associated with children’s later performance on theory-of-mind tasks. However, the attachment security on its own didn’t appear as an independent predictor once mind-mindedness of the mother was considered. This result suggests that the communicative processes within attachment relationships could at times play a more direct role than the classification of attachment on its own.³⁰⁰

²⁹⁹ Ibidem.

³⁰⁰ Elizabeth Meins, Charles Fernyhough, Rachel Wainwright, Mani Das Gupta, Emma Fradley, Michelle Tuckey, *Maternal mind-mindedness and attachment security as predictors of theory of mind understanding*, in “Child Development”, 73 (2002), pp. 1715–1726.

These findings could be particularly relevant for understanding the relationship between language and attachment. While attachment theory proposes the importance of early experiences and developed relationships, the results indicate that the mechanisms through which these early experiences influence development may be expressed through caregiver's language and caregiver's interpretation. With mothers constantly naming infants' behaviour in psychological terms, they could provide a linguistic structure that links these actions with internal states. Language, seen in this light, operates within attachment relationships as a medium through which understanding is organized even before children possess expressive linguistic abilities themselves.³⁰¹

All of the perspectives discussed in this subchapter collectively suggest that language development emerges through the ongoing interactions between early experiences and cognitive organization. Bowlby's concept of internal working models highlight's how early attachment relationships shape children's expectations about communication and social interaction. From a cognitive standpoint, Piaget's theory of sensorimotor development shows how representational capacities arise gradually, while Vygotsky's view situates language within social interaction and proposes that communicative processes have their origins in interpersonal exchanges before becoming internalized as cognitive functions of each individual. Mein's work offers a synthesis and clarifies how experiences related to attachment may influence language by identifying caregiver's interpretations and linking communication with internal states. We can conclude that before children speak, mothers speak for them, interpreting their gestures and sounds

³⁰¹ Ibidem.

as meaningful, and it seems that it is within these early exchanges that language begins to take its shape, inside of a broader relational security provided by attachment.

Conclusion

The aim of this thesis has been to examine how early linguistic development unfolds through examining the interplay of biological preparedness, cognitive structuring, and maturation and relational experiences, with attention to the role that maternal input holds.

Across chapters, language has been approached as a complex developmental process. The discussion of different theoretical frameworks and evidence debated the nature and the origins of linguistic knowledge, as well as the systems underlying linguistic competence and language acquisition. Behaviourist perspectives, represented by Skinner, presented the mechanisms of reinforcement as central in language learning, while structuralist traditions, such as Bloomfield's, focused on observable evidence of linguistic patterns, without shifting attention to internal mental representations. Chomsky's revolutionary views of the time introduced the ideas of innate linguistic capacity that explains the concept of the uniformed and rapid acquisition of grammar could not be explained through learning from external input alone. His famously known concepts of Universal Grammar and the Poverty of Stimulus positioned language as a cognitive system grounded in biology. Usage-based approaches, whose representative is Tomasello, challenged Chomsky's necessity of innate grammatical structures and defined language acquisition as a process that emerges through pattern learning, social cognition, cumulative cultural effects, and individual communicative experiences. Corballis' evolutionary perspective gave an additional dimension to examining these processes, by situating language within neural and cognitive systems that were originally through evolution associated with action and gesture.

Rather than resolving this debate and favoring a single explanation, the analysis presented in this work suggests that elements from all of these different perspectives contribute to a comprehensive synthesis. Biological predispositions could provide constraints and possibilities, but interaction and experience successfully guide developmental outcomes.

Maternal input was followed from the prenatal exposure of infants to their mother's voice to postnatal interactions. Child-directed speech was examined with all its characteristics, showing how the change of tone, rhythm, pitch, and prosody could guide the child's attention and offer structures material that aligns with the child's capacities. Maintaining engagement with the child presupposes understanding of the child's needs and level, guiding its interest and scaffolding it in tasks that the child is not yet ready to conquer. Bilingual contexts further showed the flexibility of young minds of learning both similar and very different languages simultaneously, using complex mechanisms of code-switching and code-alteration, to arrive at the stage where they can naturally use both of their languages. Variability in vocabulary outcomes across children has been looked at through the lens of many interacting factors, each trying to portray another dimension that could potentially lead to the variety of outcomes. Some characteristics, such as temperament, rest in the child, while other, such as the socioeconomic context, rest in the child's home environment. However, caregiver responsiveness remains a dimension especially influential on the child's developmental trajectory.

The final chapter extended the topic of caregiver responsiveness and situated language acquisition and cognitive development in a discussion related to attachment theory. Bowlby's and Ainsworth's' contributed to developing a framework that could capture the effects of maternal warmth and responsiveness on one side, with maternal separation or

hostility on the other. Harlow's classical experiment showed to what extent the preference for a warm and loving caregiver figure goes, as well as how exploratory behaviour emerges and facilitates child's learning. Bowlby's concept of internal working models put forward insight into how early relational experiences shape our expectations about communication and interaction, functioning as either the child's motivation to engage with others or the child's desire to withdraw. Piaget's theory of sensorimotor development showed us how cognitive capacities emerge gradually, while Vygotsky's sociocultural theory proposed language is a concept that originates in interpersonal exchanges before it ultimately becomes internalized as a cognitive function. Proposals of Meins' work further clarified how attachment experiences are tied to communicative development and clarified the importance of caregivers' interpretations of their infants' internal states.

Across all of the work presented and evidence discussed, a central conclusion emerges: children do not enter language alone. Before they are capable of producing words independently, they are already a part of a powerful dyad that gives them ability to participate in communicative exchanges in which caregivers attribute meaning to their movements and unclear vocalizations. Before they are capable of comprehending sentence structures, they are confronted with simplified input whose ultimate goal is to engage their attention and be tailored for their capacities. Before they are able to form meaningful relationships with other people, they are cared for by their mother who they see as the main source of security and love. In their early interactions, mothers function as interpreters of their children's internal states, recognizing their needs and intentions and turning them into language that the child recognizes and eventually reproduces. The

first words that the child utters therefore present much more than a cognitive milestone, since language is shaped under the influence of biology, cognition, experience and early mother-child relationship.

To conclude, the child's first words are not the beginning of language, but the continuation of it, based on conversations that started even before they could speak.

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