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The Combination of Gesture and Speech during Parent-Child Interaction: A Longitudinal Case Study of a Monolingual British Child

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1. Introduction

In conversation, people tend to accompany their speech with gestures; the same is true for children. Many researchers have documented a cross-cultural phenomenon in which children consistently use gestures to communicate long before they begin to speak and continue to accompany their speech with gestures. Wu & Gros-Louis (2014) found that infants were likely to combine vocalisation with pointing behaviour to get mothers' attention. Balog & Brentari (2008) suggested that even at the one-word stage, children begin to adhere to adults' tendency to coordinate non-verbal and verbal behaviours. From an early age, gestures and speech form an integrated system that manifests in both the production and the comprehension of the child's language (Morford & Goldin-Meadow 1992).

This paper presents a longitudinal case study of a monolingual British child aged from 12 to 24 months with two goals. The first is to examine the correlation in the use of gestures by the child and parent during the interaction. Imitation, which also occurs in early childhood, is considered by behaviourists to be the primary process in which children learn their first language (Klein 1998: 46). At the same time, other scholars agree on the existence of an innate language process, which explains how children are able to learn languages effortlessly and efficiently (Lightbrown & Spada 2010: 20). Therefore, it is of interest to assess the extent to which parents' gestures influence children's gestures in the early stages of language acquisition. The second objective of this research is to investigate the redundancy of pointing gestures when they are combined with words to express meaning. When children start to produce words, researchers often observe the constant use of pointing and words to refer to the same object. Does gesture convey the same information as speech? How redundant is the combination of pointing gestures and words in the early year? To answer these questions, it is necessary to interpret how children combine gestures with utterances in spontaneous communication.

The rest of the paper is organised as follows: In the second section, an introduction to the stage of language acquisition, classification of gestures, and the focus on pointing behaviour will be provided for a better understanding of the research. The third section will provide the methodology for collecting and analysing the data. The result of the analysis will be shown in the next chapter, followed by a discussion.

2. Theoretical background

The second year of life is an important stage of language production, during which researchers have found a high degree of similarity in the process of first language acquisition in children around the world. It is possible to divide language development into hierarchical stages: *single-word utterances* at 10-18 months, *two-word utterances* at 18 months, *telegraphic speech* at 2

years and *full sentences* at around 2.6 years (Harley 2014: 105). During the single-word stage, children start to name objects, actions, movements and people around them with certain phonetic limitations due to the immature vocal tract (Lightbrown & Spada 2010: 6-7). With a vocabulary of at least 50 words, children combine words creatively to express various semantic relations. The utterance becomes longer and more comprehensible over time, even though function words and grammatical morphemes are still missing. Their sentences resemble telegraphic speech rather than that of adults, and children eventually produce complete sentences.

Children use gestures before they start talking; later, gestures and words become a combination. It is essential to separate communicative gestures from other non-verbal behaviours or sign languages. Gestures such as note-taking, scratching, and leg shaking may have some impact on the conversation; nevertheless, they convey no communicative intention. While communicative gestures predominantly accompany speech, sign languages function as a language on their own with linguistic properties and are mainly used in the absence of speech (Tellier 2009: 2-3). Scholars agree that non-verbal communication is an integral process in spoken languages. McNeill suggests a classification of four hand gesture types found in non-verbal communication:

- *Iconic* gestures resemble physical phenomena that illustrate speech. The speech and the iconic gesture co-express the same event but are not identical. For instance, the speaker approaches the thumb and the index finger to demonstrate the object's size while mentioning the object.
- *Deictic* gestures, such as pointing and reaching, show directions or refer to objects, places or actions. The speaker can point at an object while saying, "This one", to indicate the desired object¹. Concrete pointing is one of the earliest gestures observed in children, while abstract pointing develops later in childhood.
- *Metaphorical* gestures have a specific meaning and represent an abstract idea. One of the most common gestures is the shape of two fingers, the V representing victory.
- *Beat* gestures are used to maintain the rhythm of speech, emphasise aspects of speech and do not carry any semantics.

(McNeill 2005:38-41)

¹ Even though this is a classification for hand gestures, deictic is not limit to pointing by hand. In the contrary, pointing gestures by different part of body can be found across culture. For instance, pointing by lips is common in the Philippines.

Most researchers agree that pointing emerges as the first communicative gesture around ten months, still, the origin of this gesture is debatable. O'Madagain et al. (2019) found evidence that pointing originates from touching, whereas Brinck (2004) claimed that imperative pointing occurs from ritualisation, and declarative pointing is a product of imitation. Nevertheless, the pointing gesture evidently has a close relationship to speech. Researchers encountered that pointing helps the child in communicative tasks and signals that the child will soon begin producing multi-word sentences. Evidence shows that children learn to transform their thoughts into words by pointing (Goldin-Meadow et al. 2007). Kishimoto et al. (2007) also present the effectiveness of pointing gestures that could elicit verbal responses from adults. By pointing to the biscuits and saying 'more', children will acquire the word they need to express under a similar utterance from their parents: "Do you want biscuits?" Özçalışkan & Goldin-Meadow (2005) provide evidence that pointing gestures help children express semantically complex information and predict changes in children's language development.

3. Methodology

3.1. Data

The corpus used in this case study contains short video recording interactions between parents and the child. The data from this study was originally a corpus used in a video-based longitudinal case study of a child's developing conversational skills published by Mike Forrester on CHILDES - Child Language Data Exchange System (Forrester 2004). All archive data on this database of children's speech on first language acquisition are allowed to use in subsequent analyses by researchers not involved in the original study.

The language background of the child, Ella, is simple and monolingual. Her family consists chiefly of four members: her parents, older sister and her. Concerning sociolinguistic features, all participants involved in these dialogues are British, white, and middle-class. She was recorded every fortnight from the age of 12 to 42 months during her meals, mainly with her father.

Three videos of the child from ages 12, 19 and 24 months were chosen to prepare the data set for further analysis. More information on the three videos taken for this research is available in Appendix A. One of the reasons that this corpus was chosen is the activities during the interaction. The child was recorded during her meal, primarily breakfast with her father, without any intention of observation. The conversation was carried out most naturally as a usual daily parent-child conversation. In this way, it is possible to observe the natural gestures of both the child and the father.

3.2. *Analysis*

It is important to mention that the unequal length of the videos results in the variable occurrence of gestures depending on the length of the video. In order to be able to compare the frequency distributions between the three videos of different lengths, the frequency counts were first normalised. As the video was taken during the meal, only empty hand gestures, i.e., the child and parent are not holding any object or an object that is not an integral part of the statements, are considered for this research. Gestures in which the child manipulated objects were deemed irrelevant to the research. However, if she held a toy but gestured towards another object, such as a dog, when saying ‘dog’, this would still be counted. In addition, gestures are also observed, whether or not they accompany speech.

In the second step, the gestures were classified according to the categories defined by McNeill with four types of gestures: (1) deictic, (2) iconic, (3) metaphoric and (4) beats (McNeill 2005:38,41). Some gestures, such as hand clapping or gestures during singing, were identified as either iconic, beats or metaphoric, depending on the level of concreteness and abstraction of the information being conveyed. Those that support the rhythm were marked as beat gestures. In the third step, only pointing gestures accompanied by comprehensible utterances were investigated for the redundancy of gesture-speech combinations. The pointing gestures were classified by the communicative intentions: declarative or imperative. Children use imperative pointing to ask the adult for something, which may be an object or a specific action. On the other hand, declarative pointing is used to direct the adult’s look towards an object to share their interest in something (Cochet & Vauclair 2010: 130). To clarify the redundancy of the gesture-speech combination, the child’s utterances were also analysed on the syntactic and semantic levels. Gestures that shared the same information as utterances were marked as ‘same meaning’ as seen in example (1a). Otherwise, gestures that complemented speech and conveyed different information from the utterances were marked ‘complementary meaning’ (1b).



(1a) Chi: bowl



(1b) Chi: More

4. Results

4.1. General finding

Before focusing on the gesture relationship between the child and the parent, a comparison of the overall gesture rate was taken into account. From the corpus, a dataset of 124 empty-handed gestures with their utterances from both the child and her parents² was collected. Relative frequencies of gestures per minute from the child and other participants between 12 and 24 months are presented in Figure 1³. The results revealed that the child had already used gestures in speech by the age of 12 months during interaction with her parent. Overall, Ella produced fewer gestures than her parents at 12 months but tended to use more gestures than her parent at 19 months, with an average of 1.292 gestures/minute and 0.834 gestures/minute at 24 months. There was a significant difference in gesture use between Ella and her parent at 19 months, with an average of 1.299 gestures/minute compared to 0.544 gestures/minute.

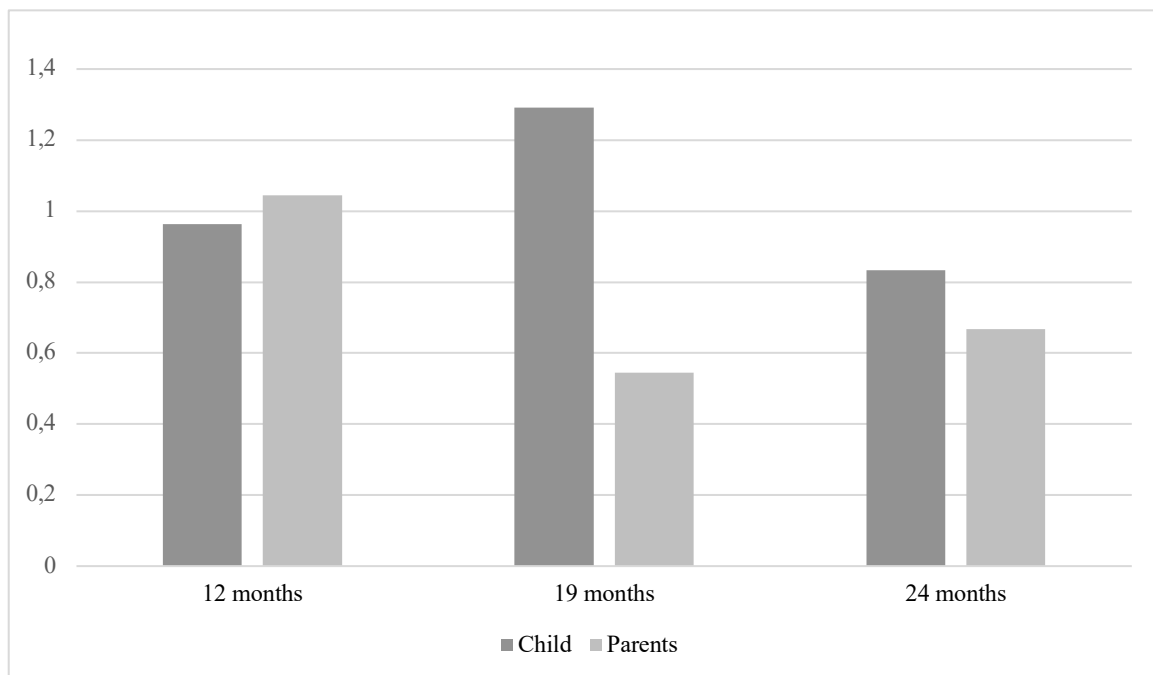


Figure 1. Frequency of gestures per minute from caregivers and the child

The child primarily used gestures while speaking. Figure 2 shows evidence of gestures-speech combination from 12 to 24 months. Only one gesture without speech was recorded at 12 and 19 months. At the age of 24 months, the child did not produce any gestures without speech. Previous work on this issue has suggested that children initially use non-verbal gestures because

² Apart from her parents, Ella also interacted for a short time with her older sister Eva. Therefore, her older sister's actions and words were counted together with those of her parents.

³ See Appendix B. for the result in numbers per video.

of their linguistic limitations and that later on, language emerges, which forms an integral combination with gestures (Iverson & Goldin-Meadow 2005: 367). The data show that children's production of gestures is similar to that of adults since communicative gestures are produced simultaneously with speech (Nicoladis et al. 1999). This inseparable connection between speech and gestures is described by McNeill as co-expressive and synchronous, meaning that they share the same ideas at the same time but are not identical (McNeill 2005: 22).

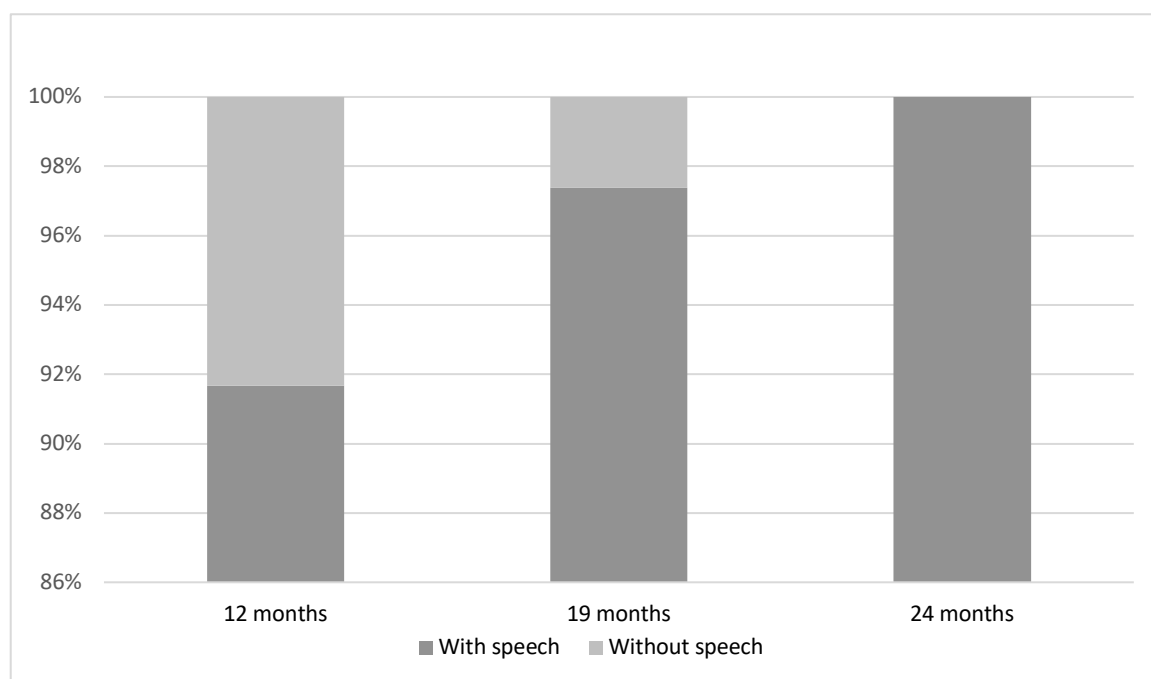


Figure 2. Percentage of gestures occur with and without speech from 12 to 24 months

4.2. *The correlation of gestures between caregivers and children*

There is a significant asymmetry in gesture production between the child and her parent, as seen in Table 3. The findings suggest that children's gestures are not always the product of imitation, as Ella's gesture frequency distribution pattern, aged 12 to 24 months, was different from that of her parents. Overall, her parent produced all four types of gestures during the interaction across the age range studied. On the contrary, Ella produced predominantly deictic gestures as an instrument to support her speech from 12 to 24 months. From 19 months onwards, other gesture patterns can also be observed progressively. At 24 months, Ella showed some iconic gestures with an average of 0.034 gestures/min, beat gestures with 0.2 gestures/min and metaphoric gestures with 0.033 gestures/min. One limitation of this analysis is that the occurrence of gestures is highly dependent on the context in which they were used (Zinober &

Martlew 1985: 300). Thus, gesture patterns shown in the result reflect only those gestures that the child used during the mealtime situation.

Gesture types	12 months		19 months		24 months	
	Child	Parents	Child	Parents	Child	Parents
Deictic	0,978	0,018	1,258	0,408	0,567	0,4
Iconic	0	0,407	0	0,034	0,033	0,067
Beat	0	0,407	0	0,034	0,2	0,067
Metaphoric	0	0,163	0,034	0,068	0,033	0,067

Table 3. Comparison of gesture types between parents and the child (gestures/min)

The result reveals that gestures-speech combinations are not always the product of imitating the gestures of their parents. Nicoladis et al. asserted that certain types of gestures, such as beats and iconic gestures, occur progressively during the development of a given language (1999: 524). The findings are in line with previous studies that show parent gestures provide models that could influence the child's gesture production and facilitate the labelling task for referent (Özçaliskan & Dimitrova 2013). Communicative gestures, such as pointing, can at first be imitated by observing adults' gestures, but later on, children will produce them in appropriate communicative situations (Zinober & Martlew 1985: 294). For instance, Ella held a vertical index finger in front of her mouth to express that 'my doll is sleeping'. In other words, children learn to use gestures to support their communication goals, such as asking for something or expressing their interests. Others suggest that children also use gestures to signal to their parents that they are ready to receive a particular type of verbal input (Iverson & Goldin-Meadow 2005: 370). Gestures and speech, which occur synchronously and simultaneously, convey the same underlying idea and support each other (McNeil 2005: 233). The analysis leads to the conclusion that children use gestures as a target language acquisition strategy and that the gestures in their inventory emerge and then increase to resemble adult-like production over time.

4.3. *Pointing - Speech combination*

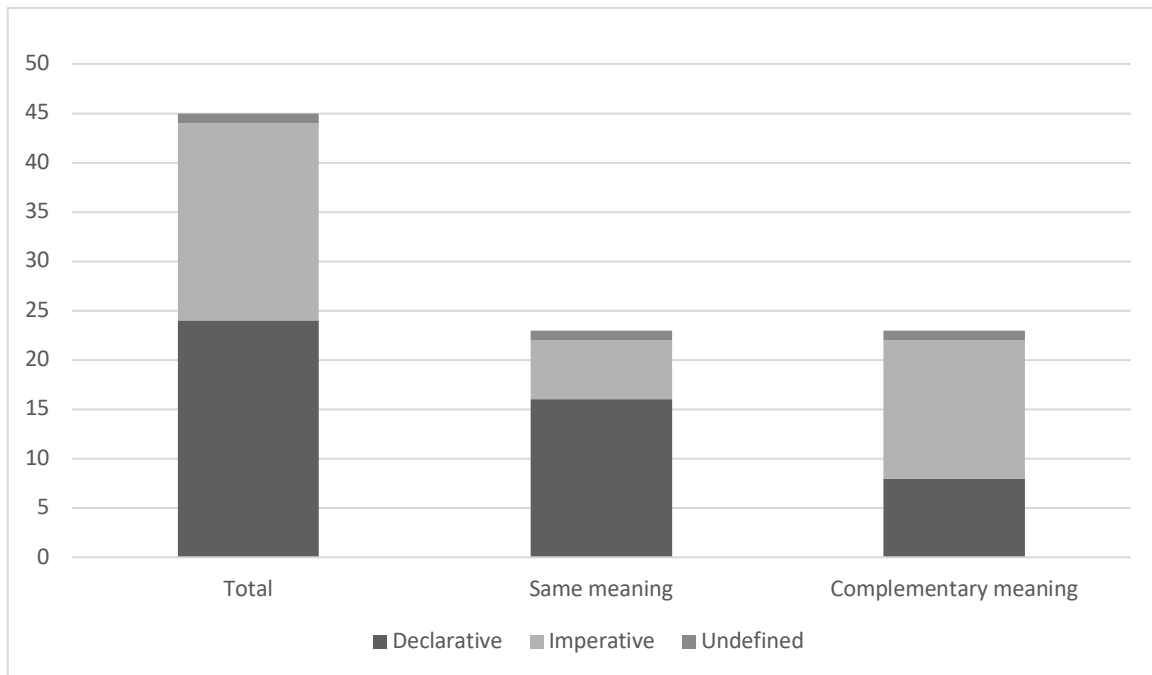


Figure 4. Relationship between speech and pointing gestures

The result, as seen in Figure 4, shows a relationship between speech and pointing. Forty-five pointing gestures were found in which the child accompanied with comprehensible utterances. The child used pointing for both declarative and imperative motives. The findings demonstrate that Ella likely produced pointing gestures more frequently with the declarative communication intention than with the imperative intention. The analysis also reveals that Ella's pointing was accompanied by utterances which conveyed the same or complementary meanings. The production of the pointing-speech combination was positively and significantly correlated with communicative intention during the second year of life. Gestures that replaced the content word were more often associated with the imperative function, whereas pointing to an object while saying the name of that object was used for the declarative intention. The result suggests that semantic redundancy hardly occurs with imperative intention since the child tends to replace words by pointing at the object. Therefore, the claim of redundancy in the gesture-speech combination is only found in the declarative function.

It seems at first that pointing at the bowl while saying 'bowl' is semantically a redundant communicative act. Why might children produce redundant gesture-speech combinations? Several suggestions can explain this phenomenon.

One possibility is that Ella used pointing as a complementary instrument to direct her parent's attention. Kelly (2011) documented a higher frequency of caregiver response to children's

communication through words + gestures than through words alone. Caregivers also looked more often in the direction of the child's point. In the present study, Ella consistently used gestures to supplement the information provided by words to create a sentence-like meaning. Thus, pointing with words are used as a strategy to support her speech and achieve communicative goals in the early years of life.

Another possible reason is that pointing to an object while naming it increases the child's vocabulary by facilitating the labelling task of surrounding objects. By pointing at the cover and saying "cubah"⁴, the child received a confirmative response from the parent, such as "it's a cover isn't it". When a mismatch occurred, the child also received a correction, such as in the following example:

CHI: more &=point → (3.3)

CHI: e::ya → (0.2)

FAT: oh more macaroni (0.6)

FAT: that's called macaroni↓ → (0.5)

CHI: mac:: → (0.6)

Indeed, there is evidence that sentence-like ideas are initially conveyed by gestures before emerging later in the verbal lexicon (Iverson & Goldin-Meadow 2005: 370). Hence, the gestures are used potentially as a strategy to facilitate the emergence of the first speech combinations.

A final possibility is that redundancy results from the emergence of language. During early childhood, the information set is mainly expressed in one or two words during language emergence. Semantic cues are used to construct syntactic representations (Harley 2014: 136). For example, by saying 'mama', the child may want to express more than one statement: "Come here, mama", "This purse belongs to mama" or "There is mama" (Rowe & Levine 2014: 236-237). A clear example from the data is by using the combination of pointing and saying "dolly" + "cheese", Ella managed to express that her doll eats (or does not eat) cheese.

5. Conclusion

The study showed the relationship between gestures and speech through a longitudinal study of a monolingual English child during mealtime with her parents. The data provide evidence that the child had already used gestures by the age of 12 months, and she combined gestures with speech to express herself freely despite the limitations of early language development. Like her

⁴ With some phonetic limitation

parent, Ella's gestures are produced simultaneously with words. The high frequency of the gesture-speech combination shows that gesture is part of a system integrated with speech.

The results responded to the two main research concerns. It is suggested that children do not always imitate the gestures of their parents but have learned to apply them gradually in appropriate contexts and to support their speech. Ella tends to produce mainly deictic gestures between 12 and 24 months. By the end of the second year of life, some iconic and beat gestures are also observed. In contrast, all types of gestures, such as deictic, beat, iconic, and metaphoric, are only found in adults. One suggestion is that parents provide gesture models that could influence the child's gesture production. The study focuses on the development of the 12-24-month-old child, so it is uncertain when gesture production will resemble that of the adult. This is a question for future research.

Pointing gestures, a ubiquitous act seen early in child development, have been shown to have a strong relationship with speech. Two distinct communicative intentions, declarative and imperative, have been encountered in data where gestures accompany utterances but in different patterns. Imperative pointing is often used to replace content words, and the redundancy of the pointing gesture-speech combinations can only be found in the declarative intention. Nevertheless, the child likely used declarative gestures to direct the listener's attention and facilitate lexical acquisition tasks.

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Appendices

Appendix A.

Ella's exact age, the number of participants in addition to the child, the types of speech and the length of the video used in the research:

Age	01;00.27	01;07.20	02;00.03
Participants	Father, Sister	Father, Mother, Sister	Father, Mother
Speech type	Holophrastic	One-word, Two-word utterances	Multiple word utterances
Video length	0:12:30	0:29:25	0:29:59

Note. The age is coded in the format years;months.days. The duration of the video is coded in the format h:mm:ss

Appendix B.

The number of gestures per video:

Age	01;00.27	01;07.20	02;00.03
Child	12	38	25
Gestures with no speech	1	1	0
Parents	13	16	20
Total	25	54	45

Appendix C.

The number of gestures according to their type:

Gesture types	01;00.27		01;07.20		02;00.03	
	Child	Parents	Child	Parents	Child	Parents
Deictic	12	1	37	12	17	12
Iconic	0	5	0	1	1	2
Beat	0	5	0	1	6	2
Metaphoric	0	2	1	2	1	4

„Hiermit versichere ich, dass ich die vorliegende Arbeit selbständig verfasst und keine anderen als die angegebenen Hilfsmittel benutzt habe. Aus fremden Quellen Übernommenes ist kenntlich gemacht.“

[30.08.2022] [Anh TO]