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Bodily expressions of dominance in children's reasoning: an analysis of multimodal and sociometric data

This case study explores how two Hungarian children argue for their choices in a decision-making task in which they were asked to pick objects useful on a deserted island. The study involves an analysis of the multimodal data of the video-recorded tasks, carried out as pair-work, and sociometric background data that were collected in order to build an initial understanding of the participants' social relations. The aim of the study is to discover how dominance relations manifest in bodily acts during reasoning. Results show that dominance was expressed by specific embodied strategies such as by taking away objects or replacing them, and that the bodily gestures were closely intertwined with the children's verbal argumentation. Further, it was observed that bodily acts were significant from the point of view of decision-making.

Keywords: reasoning, pair-work, problem solving, multimodality, interaction analysis

1 Introduction

This article is part of a more extensive study in which Hungarian children's reasoning strategies are studied. For this purpose, a particular decision-making task was designed where research participants were asked to choose 7 out of 14 objects to be taken to a deserted island. The task was to be completed in the mother tongue of the children (Hungarian). This article focuses on analysing how a pair of nine-year-old children reason when solving a task, giving particular attention to their use of embodied means. The children first completed the task alone after which they were interviewed by the researcher and asked to justify their solutions. After some time, the same task was carried out with a partner. For the present study, the focus is on the analysis of the pair-work situation. However, the differences between children's individual choices and those made during the pair-work will be commented upon. The analysis focuses on how children use gestures in their arguments. Further, the results of a sociometric analysis (Mérei 1971/2004) provide information about the children's position in their social network at school. These will be used to speculate how the position may be seen in the dominance relationships of the interaction. This case study contributes to a more detailed understanding of children's reasoning (Abrahamson, Trinic & Gutierrez 2012; Gerofsky 2011; Walkington, Boncoddo, Williams, Nathan, Alibali & Simon 2014) and provides information about bodily manifestations of dominance (Schmid Mast & Cousin 2013) as well.

2 Theoretical background

Traditionally, reasoning is defined as "the process of making certain statements, which we call reasons, in support of other statements, which we call conclusions" (Mayes 2010: 93). However, the human aspects of language are excluded from this definition. Firstly, this view does not take into account the speakers' emotions, opinions and attitudes, although reasoning, similarly to other language activities, should not be simplified to its "objective propositional content" (Ishino 2007: 243). Secondly, as Ehrlich (2011) points out, the traditional approach is decontextualized and it seems to be unsuitable for investigating naturalistic interaction where everything is intersubjective.

It can be suggested that a more appropriate perspective on reasoning is to be found in the frameworks that do not deprive language activity from its natural milieu and analyse social interaction in context (Ehrlich 2011). Further, as dialogues take place in situated activities, it is important to involve the aspect of embodiment. That is, also speakers' relations to each other, the spatial environment with the surrounding objects

and the verbal and nonverbal aspects of the interaction are semiotic resources of meaning-making and should be taken into account in interactional analysis (Goodwin 2000).

As indicated by previous research, verbal and nonverbal dimensions of language are closely synchronised. For example, people who are blind from birth use gestures even when they talk to a seeing partner (Iverson & Goldin-Meadow 1997; Iverson, Tencer, Lany & Goldin-Meadow 2000), and it has been observed that not only speech but also gestures are affected and may disappear in aphasia (Scharp, Tompkins & Iverson 2007). Importantly, it has also been found that gestures may carry information that is different from speech, and that the interpretation of verbal expressions may only lead to a partial understanding of a situation (e.g. Goldin-Meadow & Sandhofer 1999). Further, information that is received bodily can be recalled verbally and vice versa (Cassell, McNeill & McCullough 1999; Kelly, Barr, Church & Lynch 1999).

In contrast to earlier hypotheses which have claimed that gestures substitute for speech, it has been observed that bodily acts are present in parallel with verbal activity (McNeill 1985: 350; Bull & Doody 2013: 206). Thus gestures are intertwined with speech in terms of, for instance, syntax, meaning or vocal stress (Bull & Connelly 1985), and they also communicate emotions and social attitudes (Bull & Doody 2013: 215). Consequently, reasoning, just like any other language activity, is also connected to embodied cues. However, and importantly for the present study, one needs to take into consideration that meaning-making with gestures is visual and spatial while speech is vocal (Kendon 1982) and that therefore verbal and nonverbal cues of reasoning may have a different potential.

There is a number of studies that have investigated the functions of embodied acts for cognitive processes (Bjuland, Cestari & Borgersen 2007, 2008; Ehrlich, Levine & Goldin-Meadow 2006). A growing body of evidence shows that gestures may support learning (Goldin-Meadow 2004; Cook & Goldin-Meadow 2006; Cook, Mitchell & Goldin-Meadow 2008), especially by improving memory (Kelly, McDevitt & Esch 2009). In addition, it has been argued that movements support conceptualization (Hostetter & Alibali 2004) and that gestures may be considered as key elements of explanations in spatial problem-solving situations (Chu & Kita 2012; Ehrlich et al. 2006). Further, acting with their hands may support children in proportional reasoning (Abrahamson et al. 2012), and it may also help them to understand mathematical relations (Gerofsky 2011). Walkington et al. (2014) found that children were more able to present mathematical justifications with the help of gestures than by using pen and paper.

Embodiment has also been extensively studied from the point of view of social meaning-making (for a thorough overview, see Nevile 2015), and there is a number of studies that have dealt with children in particular. Children's interactions have been

studied in the context of naturally-occurring situations, especially during play activities (Goodwin 1995; Goodwin & Kyratzis 2007; Goodwin, Goodwin & Yaeger-Dror 2002) and in the context of family discussions (Rauniomaa & Keisanen 2012; Goodwin & Cekaite 2013). Also classroom interaction, especially second language learning context, has been one of the research foci (see, e.g., Kääntä & Piirainen-Marsh 2013).

However, the role of gestures in children's reasoning has not been investigated from the viewpoint of the relationship between the participants and the dominance therein. The aim of this study is to examine whether dominance can be seen in gestures used for reasoning in the decision-making task and if so, provide information on what kinds of means are used by the participants.

3 Data and methods

3.1 Data collection

The data were collected in a Hungarian elementary school in January 2014. For the more extensive study, twenty-seven 9-year-old students of two classrooms (12 boys and 15 girls) participated. All children were asked to solve a decision-making task: first independently and then with a pair. After the individual task, the students were interviewed by the researcher about the reasons for their choices. Both the interviews and the pair-work situations were video-recorded. Further, the children filled in a sociometric questionnaire (Mérei 1971/2004). The current study is an exploratory case study for which two children were chosen as research participants.

The data collection took three weeks. During the first week, I introduced myself and aimed at creating a comfortable relationship with the students with the help of small talk, common activities in the Arts class and personal meetings. On the second week, the pupils were asked to fill out a standard sociometric questionnaire in Hungarian (Gebauer 2008), which consisted of following questions:

1. Who are your friends in the class?
2. Who are the cleverest students?
3. Who make the class laugh with their behaviour and humour?
4. Who are notified by the teacher most often because of misbehaviour?
5. Who would you sit with in the same train cabin in a class trip?
6. Who are liked by the teachers the most?
7. To whom could you tell your secret?
8. Who could organise a school Christmas party?

9. Who are the best in sport?
10. Who are the weakest students?
11. Who could substitute the teacher for a lesson?
12. Who would you invite to your birthday party?
13. Who are the most popular ones in the class?
14. Who have the best clothes and accessories?
15. Who are the least popular ones in the class?
16. Who could represent the class in a cultural quiz?

First I introduced the task: "We (the head teacher and the researcher) would like to know how the relationships are evolving in this class. For this, I will give you today a special task". The aim of the introduction was to make the children feel that it is an important task and that their cooperation is essential for the success of the study. This was followed by instructions, such as: "You will find simple questions on the paper, and you have to answer with the full name of one, two or three classmates for each question." After that I ensured that they understood the task. The students had a maximum of 30 minutes to fill out the questionnaire.

Finally, during the second and third weeks, children completed the decision-making task. The settings were video-recorded during afternoon day-care service. Attending the service is mandatory and the students often do their homework there under the supervision of a teacher. This period was the most appropriate to carry out the recordings as the situation was less official than the classroom context. The students were enthusiastic to take part in the research, and they gave me positive feedback about the task.

First, each child solved the task individually in a separate room. Secondly, they were asked to form pairs and they could choose their pair themselves. If they had no preference, I formed the pairs randomly: the case presented here is an example of this latter situation. The task chosen for this study was also particularly rich as to its variety of gestures.

The children were slightly nervous before the video-recording, but they soon felt more relaxed when I ensured them that their classmates were not allowed to watch the tapes. The task was introduced as follows:

> This will be a little bit different from what you are used to do in the classroom. Imagine that you end up in a deserted island. What kind of tools would you need there? I give you this box with 14 objects, and your task is to choose seven which you would like to take with you. It is important that you could provide the reasons why you chose these particular tools. I will ask you about this when you have finished.

Then I gave the child a box in which there were dried peas, a magnifying glass, a book of herbs, band aids, antiseptic gel, gauze, nails, rope, a tin of food, a matchbox, and a picture of an axe, a knife and a saw. Three minutes later, when the children had finished choosing their objects, I asked them to justify their choices during a video-taped interview. After a couple of days, I recorded the task in a pair-work setting.

My decision-making task was inspired by a recent paper by Köymen, Rosenbaum and Tomasello (2014) in which pre-schoolers were asked to build a zoo together by presenting them with conventional (e.g., animals) and unconventional (e.g., piano) items. However, while Köymen et al. (2014) analysed children's reasoning from the viewpoint of logical categories by Toulmin (1958), and compared the performance of three-year-olds and five-year-olds, I will focus on how dominance relations are manifested in bodily acts during reasoning.

The parents gave their permission to use the collected data for research purposes. To ensure the children's privacy and anonymity, pseudonyms are used and their faces are blurred in the video screenshots presented below.

For the present study, a qualitative analysis of one video-recorded pair-work task and the quantitative analysis of the participants' answers for the sociometric questionnaire were carried out. The participants of this study are a girl and a boy, named Anna and Dénes. Both of them have Hungarian as their mother tongue.

3.2 Multimodal data analysis

The multimodal data analysis of the video-taped task included an analysis of the bodily gestures and the verbal interaction. The gestures were identified in a data-driven manner according to what was visible in the data. As a result of this process, a set of embodied tiers were annotated in the ELAN Software along with the verbal transcription (Wittenburg, Brugman, Russel, Klassmann & Sloetjes 2006). For transcribing the verbal data, the Jefferson Notation System (Jefferson 2004) was used and complemented with the notation of embodied actions in a new line under the verbal expressions (see Appendix 1). These were written in brackets with small caps (see Kääntä 2010). Besides the transcriptions, video screenshots are provided to provide insights into the visual data. Furthermore, the time interval or the exact timing of a given action was noted as well when it was relevant from the viewpoint of the analysis.

As shown in Table 1 below, following bodily acts were observed in this particular pair-work interaction:

TABLE 1. Annotated embodied acts in the pair-work interaction.

Action and its description	Anna	Dénes
Picking up Picking up an object out of the box.	+	+
Keeping Holding an object for a longer period in comparison to picking up.	+	+
Gesticulating Different gesticulations such as opening the hands, showing the palms upwards, circling with hands around the wrists, beating with the hands up and down as well as other hand movements that the children used during explanations when expressing attitudes, opinions or ideas.	+	+
Replacing body weight Replacing weight from one side to the other side of the body. Hands and legs are involved in this movement in the rhythm of speech.	+	+
Pointing Pointing at an object.	+	+
Demonstrating Miming how an object could be used; activity intertwined with speech.	+	-
Placing Placing an object on one side of the box among the selected ones.	+	+
Taking away Taking away or attempting to take away an object from the partner's hand.	+	-
Showing up Showing up an object to a partner.	+	+
Touching Touching an object.	+	+
Regulating Any act used to direct the flow of the interaction, e.g. accepting, rejecting, emphasizing. A huge variety of movements was observed. For practical purpose, I use a single term for all of them here.	+	+
Putting back Taking an object out of the box but then putting it back.	-	+

In the above classification, I have drawn upon research on gestures. For example, Ekman and Friesen (1969) distinguish between gestures that have emblematic, illustrative or regulative functions. Regulators control the flow of the interaction and usually appear in various forms and in connection with other bodily acts. These were observed when the partner's proposal was accepted or rejected, one's own ideas were expressed, a turn to the partner was given, and when the speaker referred to the time-flow of the conversation (to stop for a while, to move on, to do it more quickly), etc. Initially, I labelled all observed movements with a descriptive term (e.g. beating with the hand in the air, waving with the hand, turning the hand, opening the palms, showing the backward tensioned palm

to the partner). After that, I further developed my annotation because it was clear that one movement could not be interpreted in isolation from other movements and verbal speech. As a result, I applied a functional approach and established a category that highlights the regulative function (Ekman & Friesen 1969). Here, I made one exception: although taking away movements have a regulative function in that they prevent the partner from implementing his or her agenda, these were annotated as a separate category because of their large frequency, easy identification and, particularly, their significance from the viewpoint of the outcome of the task.

Previous research indicates that illustrative gestures help understand the speaker's view and contribute to expressing thoughts and recalling information (Bull & Doody 2013: 212). In this study, demonstrations, gesticulations with hands and arms (see Table 1) and full body movements in the rhythm of the speech were observed with this function. Emblems were not annotated as a category in this study, for although they are distinguished as a class by Ekman & Friesen (1969), in this task they seemed to have an illustrative or regulative function.

3.3 Sociometry: focus on children's reflections on their peer network

To gain a perspective on how the children's social network might have an impact on their interaction and reasoning, sociometric analysis was used. Sociometry is a quantitative technique to measure social relationships in a community. Originally, the method was introduced by Moreno (1951) but it has been developed further by Mérei (1971/2004). As the children's answers reflect their views on the social status of their classmates and the social networking within the community, also this information is used to provide an additional viewpoint to the interpretation of video data.

In the sociometric analysis, a child's position in the community is defined by reciprocity and frequency indexes. While the reciprocity index shows how many times a particular child answered with another child's name, the frequency index shows how often and for which questions a child's name was mentioned (Mérei 2004: 148–149). Further, the questions may have a positive or a negative loading. Questions such as "Who are your best friends?", "Who are the best in sport?" indicate a positive reputation while questions such as "Who are the weakest students?" suggest a negative reputation. Positive status is defined as being popular, thus liked and accepted by peers, and negative one is associated with rejection by group mates (Bukowski & Hoza 1989). Here, every research participant's social status was identified using sociometric analysis. The analysis of the children's answers will thus shed light on their mutual anticipations and on how the children working in pairs may have evaluated each other in the task.

4 Findings

4.1 Sociometric analysis

The sociometric analysis suggested that the position of Anna was different from that of Dénes. Anna's reputation in her class seemed to be positive, and she seemed to play an active role in her community, as the figures in Table 2 indicate:

TABLE 2. Anna: the sociometric dimension.

	Questions	Function	Frequency
6.	Who are liked by the teachers the most?	+	6
8.	Who could organise a school Christmas party?	+	7
11.	Who could substitute the teacher for a lesson?	+	8
16.	Who could represent the class in a cultural quiz?	+	9
10.	Who are the weakest students?	-	1
			52

The frequency index, i.e. how often a participant's name was given as an answer, shows the perceived social role or significance of a child in the community life, and it can be either positive or negative. The significance ratio is defined in relation with the extreme values of the community. As the values of this group of children ranged from 135 to three, and as Anna's significance number was 52, it implies an average significance value in relation with her classmates. However, her name was mentioned clearly more often in positive contexts.

In comparison, Dénes was mentioned 28 times in a negative context and only five times in a positive one (see Table 3). The figures suggest that his significance value in the group was average, but that his name was mentioned more often in negative contexts.

TABLE 3. Dénes: the sociometric dimension.

	Questions	Function	Frequency
4.	Who are notified by the teacher most often because of misbehaviour?	-	12
10.	Who are the weakest students?	-	7
15.	Who are the least popular ones in the class?	-	8
13.	Who are the most popular ones in the class?	+	1
3.	Who make the class laugh with their behaviour and humour?	+	1
9.	Who are the best in sport?	+	1
1.	Who are your friends in the class?	+	2
			33

It is also to be noted that Dénes answered with his own name for questions 15 (Who are the least popular students in the class?) and 10 (Who are the weakest students?). This happened in spite of the fact that children were instructed to answer with the names of their classmates only. Dénes' responses thus seem to imply that he was conscious about his perceived status in the class, which may clearly also affect his behaviour in the task.

The two children evaluated each other rather differently in the sociometric questionnaire. Anna named Dénes as one of the most misbehaving and unpopular students in the class while in contrast, Dénes named Anna as one of the cleverest students and saw her as somebody who could substitute the teacher. The difference in responses seems to suggest that while Anna did not evaluate Dénes very highly, he seems to have placed her to a superior position – and that this imbalance may also influence both the children's anticipations and the activity in the task itself.

4.2 The task: the children's choices

First, the children's individual choices and those in pair-work were compared to examine potential differences therein. As the Table 4 below shows, although the children were willing to cooperate in order to complete the task together, creating a common ground was not always free from conflicts and there were differences in the choices:

TABLE 4. Individual and pair-work choices.

Anna	Dénes	Pair-work
rope	rope	rope
antiseptic gel	antiseptic gel	antiseptic gel
gauze	can	**gauze**
match	match	match
knife	magnifying glass	can
axe	saw	**axe**
herb book	herb book	**nails**

Here, the choices seem to imply that, as also suggested by the sociometric analysis, Anna had more influence – i.e. she decided the objects to be selected more often than Dénes – in joint decision-making. When a disagreement occurred, the end result echoed Anna's former decision in two cases. Interestingly, however, in one case they ended up choosing a new object (i.e. nails) together, although they both had chosen the same object in the individual task (i.e. herb book). Also here, it was Anna who convinced Dénes about the decision to choose the nails. In contrast, Dénes' arguments never managed to change Anna's choices.

Next, I analyse the interactional process of reasoning in more detail to explore how children ended up with these decisions. The analysis focuses on how dominance relations were constructed and expressed by gestures.

4.3 The task: video analysis

The analysis suggests that children used embodied acts and gestures during argumentation in order to construct and maintain their social position in the interaction. The following examples show that the dominance relations between the participants – as implied by the sociometric analysis and the children's actual choices – were also manifested in the embodied activity. For instance, on several occasions, Anna used various kinds of regulative gestures to decline Dénes' decision. In contrast, Dénes never protested against Anna's choices by using his hands, and only once did he apply a head shake to express his disagreement. However, he often pulled back objects towards himself in order to head off Anna's take-away movements. Furthermore, by gesticulating with his arms and hands in the air or on the table in front of himself, he seemed to signal a wish for more space. Moreover although both children were told to put the chosen objects on one side and those not selected on the other side of the box, it was almost always Anna who made the ultimate decision by putting the object to its final place. She also presented a summary of what they might need or not need.

Below, I will discuss in more detail particular sequences of decision making, illustrating what kinds of bodily acts seemed to be connected with reasoning and discussing their functions. The first example (Figures 1a–1d) shows how one's own argument is emphasised, how the partner's decision is overruled, and how the final decision is achieved with the help of embodied cues:

FIGURE 1a.

FIGURE 1b.

FIGURE 1c.

FIGURE 1d.

Transcript:

1: D {SLAPS THE MAGNIFYING GLASS NEXT TO THE CHOSEN OBJECTS} (Figure 1a)
{SLAPS HIS PALM ON THE TOP} (Figure 1b)

2: A de ez nem kell nekünk↑de elmondjam miért?
but we don't need [this]↑ but should I tell you, why?
{[REPLACES MAGNIFYING GLASS NEXT TO THE UNCHOSEN ONES]} (Figures 1c & 1d)

3: D na?
so?

4: A mert hiába vizsgálod meg a bogarakat meg minden, hát nem jutsz vele
because you explore the bugs and everything in vain it does not take you

This excerpt comes from a sequence where Dénes argues for the importance of choosing a magnifying glass, puts it besides the chosen ones and slaps his hand on the top of the

object (Figure 1a and 1b). However, Anna disagrees with Dénes, immediately picks up the magnifying glass and replaces it to the other side of the box where the rejected objects are (Figure 1c and 1d). One can see how the movement is connected with what is said and how the gestures affect the result of the reasoning process and, also, the outcome of the task. In fact, it was typical of both children to place their hand on the top of the object to make their own choice final.

The interaction shown above continues in the second extract (Figures 2a–2f) when Anna refuses Dénes' proposal. The rejection is expressed by a wrist twist, which is followed by showing the partner a tensioned backward left palm and closed with a take-away attempt.

FIGURE 2a.

FIGURE 2b.

FIGURE 2c.

FIGURE 2d.

FIGURE 2e.

FIGURE 2f.

Transcript:

5: D és fel akarunk mászni a fára hogy öö [megtudjuk, hogy]
and we want to climb up the tree eeh [to know if]
{[KEEPING THE ROPE FROM 01:18:122 TO 02:21:141]}(Figure 2a, 01:55:133)

6: A [de nincs semmi eszköz, nincs semmi]
[but there are no tools, nothing]
{[TWISTING THE WRIST]} and in connection to that {[EXTENDING THE LEFT PALM]}
(Figure 2b and 2c, from 01:58:122 to 01:59:786)

7: D de mos a hajó megvan
but we have the ship
{KEEPING THE ROPE AND GESTICULATING WITH IT}

8: A [ez]
[this]
{[TAKE AWAY MOVEMENT]} (Figure 2d, 02:00:845)

9: D [de most a hajó megvan], csak aa az összes cuccunkat elvesztettük. csak ezt a hat darab (xxx) és
[but we have the ship], just we lost our stuff. Only these six (xxx) and
{[PULLING BACK THE ROPE]} (Figure 2e, 02:01:910)

10 [a kötél csak arra jó, hogy most felmászok egy fára és most meg akarom nézni, hogy most hol van a hajóm]
[the rope is just good for if I am climbing up a tree and I want to check that where is my ship now]
{[GESTICULATING WITH THE ROPE IN FRONT OF HIMSELF]} (Figure 2f, 02:08:845)

11: A va::gy
o::r

12: D vagy?
or?

In the above example, Anna refuses Dénes' argument by using negation (*no tools*, *nothing*) and regulative gestures. She first performs a quick, shaky horizontal hand movement and then shows her backward tensioned, opened palm to Dénes. While this movement can of course be considered as an emblematic gesture because it is conventionalised, cultural and expresses a specific meaning even without an accompanying verbal

expression – and thus a separate category (Ekman & Friesen 1969) – it is used here in a regulative function and classified accordingly. After Anna's refusal, Dénes starts to argue for the rope, explaining that they could climb up a tree with that in order to look for the ship (see line 10). Anna applies a new strategy. This time she avoids any direct confrontations such as a take-away movement or a negative response, but instead introduces an alternative explanation. Dénes accepts this turn and creates ground for another possibility as he asks back (see line 12). During the whole sequence (58 sec) he has been holding the rope steadily (all in all, he kept it in his hands for 63 seconds), implying that he was determined to choose it. Although Anna's movement is explicit and quick, this is not the first time she tries to take an object away from Dénes, and he seems to be prepared. His defensive reaction is quicker and more confident than in the former cases. Furthermore, his response is transformed into hand and arm gesticulation and also intertwined with verbal arguments.

Further, it is seen in the data that while Anna managed to grab an object away from Dénes the first two times, her following six attempts were unsuccessful. Although the children had different ideas about how to use the rope, they both agreed that they should choose it. This was the only time when Dénes managed to ultimately place an object among the chosen ones. After Dénes' argument, Anna provided her own viewpoint about the use of a rope. The following excerpt (3a–3b) presents how Anna conveyed her view by gestures and verbal arguments.

FIGURE 3a.

FIGURE 3b.

Transcript

13: A arra, hogy ha szeretnénk túlélni, és inni szeretnénk valamit, de a tengerből nem ihatunk sem, tudod,
because if we would like to survive, and we would like to drink something, but we cannot drink anything from the sea, you know,
{DEMONSTRATION AND GESTICULATION WITH BOTH ARMS}
mert soós, és ezért fölmászunk a fára , megkötjük, és akkor (.) fölmászunk, igen, és akkor hogyha
because it's salty, so we climb up a tree, tie it, and then (.) we climb, yes, and then if

{DEMONSTRATION AND GESTICULATION WITH BOTH ARMS} (Figure 3a)
egy kókuszt kiszemléltünk, hogy azt le tudjuk szedni.
we have seen a coconut, then we can pick it.
{DEMONSTRATION AND GESTICULATION WITH BOTH ARMS} (Figure 3b)
14: D az is jó.
it's also good.
{HEAD NOD AND UPWARDS DIRECTED OPENED GESTURE WITH THE RIGHT PALM}

Here, Anna is mimicking how they could use the rope to climb a tree (Figure 3a) and to pick up a coconut (Figure 3b). Dénes accepts this argument. Although this sequence of negotiation includes both disagreements and agreements, the decision is ultimately made together since they both intend to choose the rope. It is interesting that both children want to express their own reasons and argue for them even though they agree in the end. Here, it may be suggested that the sequence is more about negotiating and constructing the social roles than about changing the other person's mind with the help of one's arguments. Also, interestingly, although there is no need to invest much effort into negotiating, this sequence is clearly the most expressive one in the data in the sense of gestures and bodily activity.

5 Discussion

The negotiations about the objects to be chosen and the differences in the dominance seemed to reflect the relationship between Anna and Dénes in a way that was at least partly anticipated by the sociometric analysis. Dominance and subordination were expressed both spatially as a consequence of the dynamic bodily interaction, and, in parallel, verbally. The examples show that some gestures were used by both children, while others were applied depending on the reasoning strategy (see Table 1). Next, I discuss the most significant observations about the visual manifestations of dominance in the children's reasoning.

Naturally, the children sometimes disagreed about particular objects they wanted to choose, or, even though they wanted to choose the same object, they disagreed about the reason for selecting it. Both children used gestures to defend their views or enforce their own agenda. For instance, both of them put their palm on the top of a chosen object. However, only Anna initiated such direct confrontational gestures as taking away or replacing objects. Although Anna's first two taking away attempts were successful, Dénes fended off her following attacks by pulling back the object. In general, however, Dénes' subordination was manifested in many different ways. For example, he often showed the object to Anna and asked her opinion about it. Furthermore, he never uttered a counter-argument against Anna's decision. Only once did he express an idea

different from Anna's – this was about how to use the rope – but also here he did not argue against his partner's choice. In contrast, Anna clearly expressed her agenda both verbally and bodily, even if it was against Dénes' opinion.

The children also seemed to have a slightly different image about the life on a deserted island. The differences were manifest in bodily acts: Anna, for example, demonstrated how she would pick up a coconut and Dénes expected to find some bugs there and investigate them with the magnifying glass. However, it was interesting to see that although the children had different agendas to promote, they were able to reach a joint decision by their reasoning. During the negotiation process, a variety of embodied acts was observed as a functional part of the argumentation. It is important to highlight that although children sometimes disagreed, their embodied acts imply that they intended to accommodate to each other's views in order to complete the task. For instance, to make their own choice explicit, they either showed or handed an object to their pair or demonstrated how they could use them. These observations support earlier research findings (see Chu & Kita 2012; Ehrlich et al. 2006) showing that gestures are important elements of explanations and intertwined with reasoning during problem-solving.

However, the power relationship between the children was also manifest in the fact that, when completing the task, Dénes just accepted Anna's arguments. In contrast, Anna seemed to be more competitive (as shown in how they discussed the use of the rope) and did not give up her own agenda. Her dominance was manifested in several ways: she was the one to put the objects to their final place, she replaced an object if she did not agree with Dénes, she aimed to take away objects put aside by Dénes and she used regulative gestures to express her refusal or disagreement. These acts of conflict and compliance were an essential part of the children's negotiation – and through them their cooperation in solving the task became possible. Although there is a large amount of research on the topic, there is a need to investigate the bodily manifestations of dominance more deeply and in different reasoning contexts, because most of the existing research focuses on classroom interactions (e. g. Abrahamson et al. 2012; Gerofsky 2011).

Interestingly, the sociometric data reported above (see section 4.1) seems to support the observations made in the analysis of the multimodal data regarding dominance relations between the participants. According to the classmates' answers, Anna is popular and generally liked, while Dénes is clearly less so (see Table 2 and 3). However, it needs to be said that the present case study of two children is exploratory in nature. More research will be needed to confirm the relationship between sociometric results and the multimodal analysis of the interaction data.

6 Conclusion

The study shows that in order to achieve their own agenda, children use both verbal arguments and various gestures. Furthermore, it was found that bodily acts affect the outcome of the task. It can also be noted that some bodily gestures that were used as arguments had a recognisable and repetitive structure: each time Anna tried to take away an object from Dénes, she used the same pattern of movement. This also allowed Dénes to gradually develop his defensive gestural response through the interaction.

As it has been found earlier (Walkington et al. 2014; Gerofsky 2011), this study also suggests that body movements and non-traditional task materials may help children to create explanations and arguments. The findings suggest that it may be highly relevant to analyse children's reasoning from a perspective that aims at combining the study of verbal aspects with the analysis of embodied interaction. Moreover, here an interdisciplinary approach was used where the results of the sociometric analysis were connected with the multimodal analysis of interaction data. This approach was also seen as potentially advantageous in that it illustrates aspects of the relationship the participants have in their joint social network at school.

7 References

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