Rule Explanation in Children: A Multimodal Perspective

Kristine Lund[1], Louis Maritaud[1], Audrey Mazur[1], Muhammad Ashiq[2],
Brendan Eagan[2], and Yeyu Wang[2]

[1]University of Lyon
```
kristine.lund, louis.maritaud,
  audrey.mazur[@ens-lyon.fr]
```
[2]University of Wisconsin-Madison
```
ashiq, beagan,ywang2466[@wisc.edu]
```

Abstract. This study is conducted across four classrooms of different age groups in a French school. Students in each class play a game in groups of four. In this game, students take on two main roles with one instructor and three players. The instructor explains the rules of the game to the other three players. We aim to investigate verbal and non-verbal behaviors of rule explanation and intercomprehension checking across age groups, using Transmodal Ordered Network Analysis (T/ONA).

Keywords: T/ONA, Multimodality, Psycholinguistics, Language development

1   Area and Domain of Research

This proposed research study is in the domain of learning sciences, linguistics and psycholinguistics.

2   Background

The process of constructing cohesive and coherent discourse varies for different age groups of children [1]. To explore this phenomenon, numerous studies focus on children's explanation from a multimodal perspective [2]. In a recent study [3], it was reported that: (1) children rely on the gestural modality of language to construct their message and introduce information, and do so increasingly as they grow older, and (2) children also manage interactional constraints better and better during a game explanation task, in particular by increasingly checking intercomprehension or responding more to interlocutors' requests.

Due to the interdependency across multimodalities (including dialogue, gaze, and gesture), we plan to adopt Transmodal Ordered Network Analysis (T/ONA) to represent

patterns of connection-making in children's intercomprehension. Thus, we can specify a unique window length for each modality (dialogue, gaze, and gesture) based on their temporal influence projecting to future learning events in the context of children's intercomprehension.

3   Research Objectives and Preliminary Exploration

To explore children's intercomprehension across different age groups, we observed and recorded interactions of 114 children during 28 game-playing sessions. Specifically, we focused our analysis on the process of rule explanation within a small group of four or five children. In each small group, one student was selected as the "instructor", explaining the rules of the game to the other group members. During rule explanations, children engaged with gaze, dialogue, and gestures to explain their understanding of game rules. Through this process, we can also observe how children in different age groups negotiate shared understandings within a competitive environment. Hence, in this preliminary study, we will explore the following questions: (1) What are patterns of intercomprehension during rule explanations across multimodalities? (2) How do patterns differ for different age groups (approximately 8-9, 9-10, 10-11, 12-13 years old)?

To analyze patterns of rule explanations, we manually coded critical behaviors for this intercomprehension process using ELAN software [4]. For each turn of talk or recognized meaningful behavior, we coded the segment from four aspects: (1) whether the action was verbal only (dialogue) or multimodal (dialogue accompanied with gestures); (2) whether the explanation was correct or incorrect; (3) whether the explanation was complete or incomplete; (4) whether the instructor conducted intercomprehension checking with other players verbally or through gaze. To answer the two research questions, we constructed a grand mean T/ONA model using nine codes based on these four dimensions.

To answer the first research question, we constructed a grand mean T/ONA model using these codes. In the preliminary result, we observed strong bidirectional connections between correct and complete explanations for both verbal relevance and multimodal relevance. This indicates that to make a correct explanation of game rules with thorough details, children usually engaged with both dialogues and gestures. To explore the second research question, we further constructed T/ONA subplots for different age groups. In this study, participants are children from four classrooms (CE2, CM1, CM2, and 5) in different age groups (approximately 8-9, 9-10, 10-11, 12-13 years old respectively). Based on the means rotation to maximize the variance explained by age, T/ONA shows different patterns for the youngest groups and the eldest groups: while young children made more connections within verbally relevant expressions and gestures with details, older children tended to skip the details in their gestures and dialogues. Additionally, older children conducted more intercomprehension checks both individually and collectively. Based on the preliminary studies, we discovered patterns of rule explanation using multimodalities across different age groups. Along this line, we will explore the following questions as the next steps:

- Fine-tune TIFs for different modalities.

- Add phatic gaze behaviors to understand the impact of non-verbal behaviors contributing to intercomprehension among children of different ages.

References

1. Hickmann, M. et al.: "Organisation référentielle dans les récits d'enfants en fonction des contraintes contextuelles, Enfance 2". (1995, pp. 215–26.
2. Colletta, J. et al.: "Multimodal explanations in French children aged from 3 to 11 years". Expository Discourse in Children, Adolescents, and Adults. Development and Disorders, New York: Psychology Press, Taylor & Francis, (2009), pp. 63–97.
3. Mazur-Palandre, A. et al.: "Alors , lá, je vais vous expliquer comment on joue!" (2021).
4. Wittenburg, P. et al.: "ELAN: a Professional Framework for Multimodality Research". Proceedings of LREC 2006, Fifth International Conference on Language Resources and Evaluation, (2006).