



The interplay between I and We intentionality

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Abstract

We and I intentionality appear to be two distinct forms of human intentionality, as one cannot be explained in terms of the other. We-intentionality is part of the psychological infrastructure at the basis of human cooperative behavior, while I-intentionality is potentially more related to competitive relationships with conspecifics. Our work tries to empirically address the relationship between these two forms of human intentionality as exhibited during the early stages of human development. The experimental setting consisted of four different games, two competitive and two cooperative. We focused our experiment on three age groups and schooling: Early Elementary School Children (mean = 5 years 6 months; $\sigma = 4.2$ months), Late Elementary School Children (mean = 9 years 4 months; $\sigma = 7.5$ months), and Adult University students (mean = 21 years; $\sigma = 11$ months). The key aspect of the investigation was that only one participant was informed of the game, rules, and reward. The second participant came to the set uninformed. It was the first participant's decision whether and how to engage the latter in the game. We were especially interested in the communicative behaviors: when and how the informed participant would share his or her information. We observed that the Adult University Informed participants shared their information with the Adult University Uninformed participants, while this almost never happened in Early Elementary School Children. Late Elementary School Children presented a split halfway between keeping and sharing the information. The results seem to support the hypothesis of a developmental relationship between the two forms of intentions. They also suggest that the two forms of intentionality are complementary. Each plays a specific role in human relationships with social and physical environments: the We-intentionality would establish the common ground within which the I-intentionality would manifest itself.

Keywords Intentionality · Shared intentionality · Communication · Cooperation · Competition

Introduction

There is growing empirical evidence to support the view that, from the second year of life, humans start developing a particular form of intentionality, the "We-intentionality"

or Shared Intentionality (Tomasello, 2019; Tomasello & Carpenter, 2007). Shared intentionality, which constitutes the core of the uniqueness of human cognition, is unable to be reduced to the other form of intentionality, known as "I-intentionality" (Rakoczy, 2016; Tomasello et al., 2005; Tomasello & Rakoczy, 2003). Individual intentionality refers to the power of a person's mind to be about, represent, or stand for things, properties, and states of affairs. It is the capacity of individuals to have thoughts, beliefs, desires, and goals that are directed toward specific objects or aspects of the world (Malle et al., 2001). In other words, it is the ability of an individual's mental states to be intentional, to have content, and to refer to something beyond themselves. Meanwhile, Shared or Collective Intentionality is presented (see Searle, 1990; Tuomela, 2007; Bratman, 1999; Gilbert, 2009) as an irreducible category of intentionality: just as there is individual intentionality of the type "I intend that..." so there is a collective intentionality of the type "we intend that..." When we are engaged

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in collective action, we do what we are doing as part of our doing what we are doing (e.g., carrying a table, taking a walk, playing tennis, etc.). This capacity, like individual intentionality, is rooted in the biological substratum of the individual and must be thought of as equally original as individual intentionality. It must be, to use Searle's own words, a biological primitive. However, originally, for Searle (2005), collective intentionality underlies all social phenomena, both human and animal. But Tomasello has produced empirical evidence that does not fully corroborate Searle's assumptions regarding Collective (or Shared as Tomasello prefers to call it) Intentionality. Whereas individual intentionality would be shared with other primates and would characterize competitive relationships with conspecifics, Collective Intentionality would be a uniquely human characteristic and would be a component of the psychological infrastructure underlying specifically human cooperative behavior (Tomasello, 2008). Contrary to what Searle proposes, experiencing someone as an intentional agent is not in itself a sufficient condition for the formation of Shared Intentionality. Evidence from the study of primates refutes this idea of an automatic transition from individual to collective intentions. Chimpanzees show that they understand the intentionality of others' actions, being able to distinguish even between intentional and accidental actions (Call & Tomasello, 1998). They are not only able to read the intentionality of a performed action but also to interpret a missed action, reacting quite differently depending on whether the experimenter fails to perform the action (e.g., handing a peanut to the monkey), fails at the task, because he is unable or because he does not want to do it (Call et al., 2004).

Despite this sophisticated ability to interpret intentions, however, chimpanzees are unable to participate in collaborative activities based on shared goals and intentions. What do they lack to collaborate? The hypothesis proposed by Tomasello is that primates lack the special motivation to share that characterizes human relationships from the earliest months of life. Thus, human sociality lies in the ability to engage in irreducibly collective "we" intentionality. This ability encompasses shared activities, cooperation, and participation in collective practices and contributes to the development of a normatively structured public space, which is integral to the concept of personhood. It is within this theoretical framework that we use the term Intentionality.

Accordingly, while the I-intentionality, also known as "individual intentionality", is seen in other primates, and appears to play a relevant role in the competitive behavior between conspecifics (i.e. dominance hierarchies), the We-intentionality is a uniquely human characteristic and part of the psychological infrastructure at the basis of human cooperative behavior (Tomasello, 2009). In the following we try to investigate the interplay between the two forms

of intentionality as it evolves with age in humans. To this aim we introduce an experimental paradigm based on the analysis of communication patterns.

The working hypothesis

The seminal work of Vygotsky (1978) and of Moll and Tomasello (2007) proposed that Shared Intentionality would not only allow the passage from dyadic and imperative intentions to triadic and communicative ones, but also foster the transformation of the whole set of human cognitive processes, marking it as an irreversible and unpredictable part of human evolution. For example, the space–time coordination activities, typical of hunting or gathering in primates, were transformed, even in spite of individual concerns, giving way to cooperative activities such as agriculture, trade, and power struggles within social groups (Standage, 2009). Thus, the forms of social learning based on observation of others were transformed into forms of deliberate transmission of knowledge and practices, that is, the phenomenon of teaching. More generally, the emergence of this new form of intentionality ("We-intentionality") transformed and complicated our human cognitive functions, evolving our capacity for social interaction (Warneken, 2018).

The acceptance of this idea of Shared Intentionality would imply the significant consequence that human cognition could be permeated by two forms of intentionality: the individual one that is predominantly competitive and present in other primates, and the shared one that is essentially cooperative and specifically human. Rakoczy (2008), following the seminal work of George H. Mead (1934) and Lev Vygotsky (1978), suggested that a dialectical relationship exists between the two forms of intentionality. The dialectical relationship, according to Vygotsky's General Law of Cultural Development, evolves such that as humans begin to deal with their social environment, new directions of psychological development generate which transforms a child's cognitive processes, including those relating to intentionality.

Until now, most experimental research has focused on whether or not We-intentionality is ascribable to I-intentionality. This study, however, was designed to explore questions about the relationship between individual and Shared Intentionality. Delving deeper into the specifics to gain insight into a potential changing relationship with age between the two types of intentions, which hasn't been explored previously.

The questions that we asked are as follows: is the relationship between I- and We-intentionality already well-established in children 5–6 years of age or does it change within those years? In the event of a changing relationship, what direction does it take? Using two forms of games, competitive, which would rest more on I-Intentionality,

and cooperative, which would be more associated with We-Intentionality, are we able to conclude whether behaviors change based on the type of game?

In order to answer these questions, an experiment was designed using four different games. Two games were competitive, meaning that the goal could be reached by only one person; and two games were cooperative, meaning that the goal should be achieved by the couple on set. Using these games, we compared the behavior of three groups of participants, distinguished by age and level of schooling: 5–6 years – Early Elementary School; 8–10 years – Late Elementary School; 18–22 years – University Level.

The seminal work of Vygotsky found that the inter-psy-chic processes that are the basis for intrapsychic processes take place through human communication; therefore, human beings retain the function of communication even when they are alone. Following Vygotsky's concept, we focused our attention on when and how a communicative process occurs. The key aspect of our experiment was that only one participant of the couple knew the rules of the game; the other participant was unaware of the rules. Instructions to the Informed participant were concluded with these words: "When I say 'Start' the game can begin. But you will not be alone; another child/person will get in the room soon. He/She does not know anything about the game; He/She does not know the rules of the game nor the target to be reached, nor the associated reward. It is up to you to decide if and how to involve him/her in the game." Thus, the individual to whom we gave the instructions had the opportunity, but was not obligated, to involve the other participant.

Obviously, both participants could infer that some interactions were expected, and the focus of our study was the occurrence of communicative behaviors. When would it happen? What type of communication would it be? What would be the tendency between the three groups' behaviors when faced with activities that could be carried out in a dyadic or triadic way? We consider this an exploratory study in the direction of understanding the relationship between I and We Intentionality in humans.

Experiment

Method

Participants

The study included 48 participants from three groups, differing in age and schooling. The participants were recruited, on a voluntary basis, from three different educational institutions using the Quota sampling techniques to assure a balanced distribution of age, gender and education levels. The study was conducted in three different time periods between

2017 and 2018 in three different educational institutions within the geographic area of Siena, Italy. The first group consisted of children between the ages of 5 and 6 years, attending the Early Elementary School ($N=16$; mean age 5 years, 6 months; age range 4 years, 10 months to 6 years, 3 months; $\sigma=4.2$ months). The second group consisted of children between the ages of 8 and 10 years, attending Late Elementary School ($N=16$; mean age 9 years, 4 months; age range 8 years, 2 months to 10 years, 8 months; $\sigma=7.5$ months). The third group consisted of young adults between the ages of 18 and 22, attending the University ($N=16$; mean age 21 years; age range 18 years, 9 months to 22 years, 4 months; $\sigma=11$ months). The children belonging to the first and the second groups came from different educational institutions but the couples were always composed of individuals belonging to the same institution and class (i.e. they knew each other before entering the game). The participants of the Adult group were all from the same University, although they followed different academic courses (e.g. Engineering, History, Design, Communication Science). Participants were tested in pairs that were randomly formed within the group of origin, and the tests were carried out at their respective institutions (schools and universities). Six additional participants were not included due to problems inherent to video recording, and one child because of her shyness. The ethical authorization for the study was taken from the Ethics Committee for Research in the Human and Social Sciences (CAREUS) of the University of Siena along with permission from the local school authority, and informed consent was taken individually from the study participants and from the teachers that assisted us in the Elementary School.

Design

We used a "2×3" experimental design: two game levels (Cooperative and Competitive), and three age/schooling levels (Early Elementary, Late Elementary, and University). Furthermore, to produce a more accurate representation of Cooperative versus Competitive findings, we utilized four different games – two "Cooperate" level games and two "Competitive" level games. The articulation in two games for each class, instead of relying just on one single instance for a category, was introduced in order to attribute potential differences to the nature of the game (Competitive vs Cooperative) and not to the specific game. Participants were tested in only one of the four games. Before the game started, participants were asked to choose a random card from a bowl. The card determined the partner with whom they would be paired for the game based on the color of the card (green or blue) and the number written on the card. Participants with the same number on their respective cards were paired together; one color card represented to us who would be the

Informed participant, and the other color represented who would be the Uninformed participant (see procedure).

Tasks

The four games/tasks (two competitive and two cooperative) are depicted in Fig. 1. The cooperative tasks (A, B) were designed to be difficult for participants to reach the goal by themselves and without help, although one could try, there would be very little chance of success unless working cooperatively with a partner. In particular, the Fishing task requires explicit communication between the participants. Conversely, the competitive tasks (C, D) could be carried out by participants independently.

Procedure

Participants were gathered together in a room, separate from the experimental game room, where each picked a card from an opaque bowl. There were two sets of cards in the bowl: one set with a number on each of the cards with a given color (e.g. green), and another set with the same numbers but on a different colored card (e.g. blue). The total number of cards was equal to the number of participants in a given session; participant pairings were determined by same-number cards and Informed/Uninformed participant assignments were determined by the color of the participant's card. This process was followed for each game across all experimental groups. After pairings were determined, one of the Experimenters (E1) called a random number and random color for the corresponding participant to enter the experimental room. In this way, the color of the card was randomly associated with the Informed or Uninformed participant. After entering the experimental room the participant received instruction about the game from Experimenter 2 (E2).

The Informed participants received the following instructions in front of the experimental setting:

Pulling Box: The objective of the game is to get the prize that is on that box over there. But to get to the box you can't get past these chairs. It is, however, possible to use this rope to approach the box, but be careful the box must be placed in this little door for you to get the prize. One last but important caveat. The rope you see is not attached to the box, and if you try to pull it to you from one side it will slip out of the box. All clear? Do you have any questions?

Fishing Box: The goal of the game is to recover the prizes that are contained in these little black boxes. The black

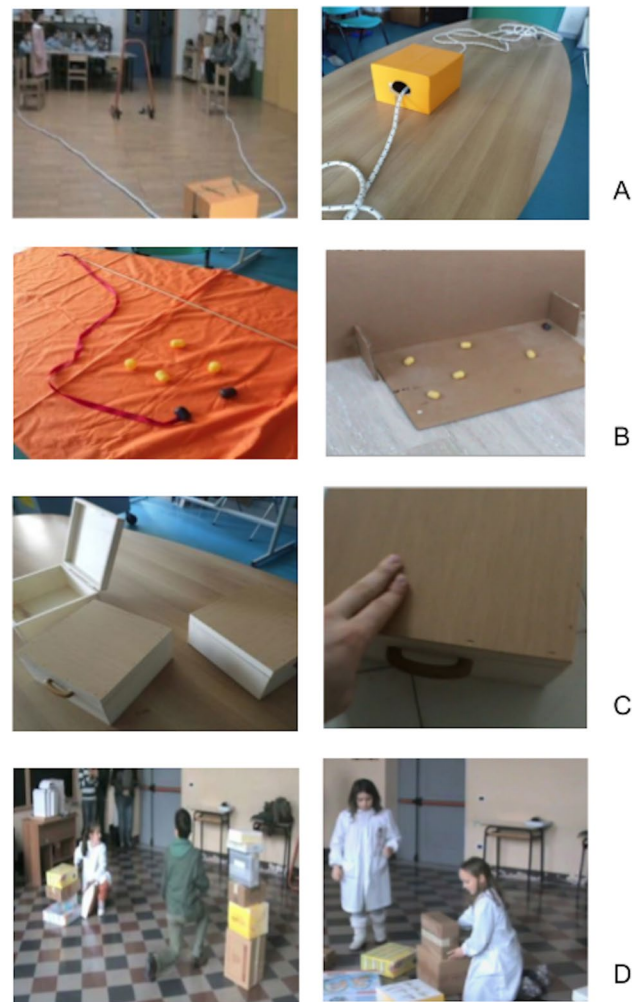


Fig. 1 The objects used for the four games: **A** Cooperative pulling box; **B** Cooperative fishing boxes; **C** Competitive opening boxes; **D** Competitive towering boxes. **A Cooperative Pulling Box:** Following the experimental settings of Crawford (1937), we had a box with a passing rope. The two extremes of the rope were located far away so that any single participant could not manipulate both sides at the same time by himself or herself. The goal was to bring the box inside a small door. Once there, the rewards located on top of the box were accessible. **B Cooperative Fishing Boxes:** A fishing stick with a magnet at the end was used to fish behind a large opaque where there were 6 boxes; each was one of two colors (yellow and black). The panel was high enough to not allow you to see the location of the boxes from the fishing distance no matter the height of the participant (see additional material). Only some of these had a magnet inside and only the 2 black boxes had a reward and a magnet inside. **C Competitive Opening Boxes:** Three boxes were set on the floor, each one containing a reward. The boxes' handles were for carrying, not for opening. In order to open the box, participants had to press on top of it to activate the mechanism. **[D] Competitive Towering Boxes:** Boxes of different sizes and shapes were provided with the goal of building the highest tower possible. The player who built the highest tower got the reward from the experimenter

boxes contain a magnet as well as the prize and are positioned behind this panel. In addition to the black boxes, there are also these little yellow boxes but they don't contain any prizes. Keep in mind that none of the yellow boxes contain the prize, only the black ones contain it. To attempt to recover the prizes you will have to use this fishing rod which has a magnet at its end and you will have to position yourself on this side of this panel and not go beyond this line. All clear? Do you have any questions?

Opening Box: The objective of the game is to collect as many prizes as possible by opening the boxes you see on the floor. Be careful though, the boxes have a secret opening, you'll have to discover it to be able to open them. All clear? Do you have any questions?

Towering Boxes: The objective of the game is to be able to make the tallest tower by impaling the boxes you see on the floor on top of each other. You can place them in any order you like, when all the boxes have been used the tallest tower will be the winner. All clear? Do you have any questions?

All the instructions to this first-called participant were concluded with the following: "When I say "Start" the game can begin. But you will not be alone; another child/person will get in the room soon. He/She does not know anything about the game; he/she does not know the rules of the game nor the target to be reached nor the associated reward. It is up to you to decide if and how to involve him/her in the game."

After making sure these instructions were clear, with special attention to the Early Elementary group's understanding, the experimenter answered any additional questions the participant may have had. Following this briefing, E1 allowed the corresponding Uninformed participant to enter the experimental room. Soon after, E2 announced "Start" so that the activity could begin. The game ended after the goal was reached, or after 10 min, whichever came first. A debriefing session followed at the end of the game. Participants could report their experiences and ask questions. E2 also explained the basis of the experiment to the participants, i.e., that they were observing the involvement of the second player.

Coding

We recorded the data for the following communicative behaviors for each observed group:

- i) The presence of communicative intentions and their directions, from the Informed participants to the Uninformed and vice versa.

- ii) The type of communicative behavior: Imperative, Declarative, etc.
- iii) The temporal phase in which the communicative behavior occurred: before the game, during the game, and after getting the reward.

The assignment of coding was carried out by three independent experimenters and then compared; the few cases of disagreement were solved by discussion. The coding served both for the quantitative analysis as well as the qualitative analysis of the participants' behaviors.

The quantitative analysis was performed by comparing the fixed responses to the following two questions:

- i) Do they communicate before starting to play?
YES / NO
- ii) Who produced an overt communicative intention first?
A: The Informed participant / B: The Uninformed participant / NO: NONE.

With regards to the qualitative analysis, the following question was foremost in formulating the results:

- iii) What type of communication occurred first?

For coding purposes, we distinguished between 5 potential types of communication:

- Shared (COND): One of the participants addresses the other with the intention to share some content.
- Imperative (IMP): One of the participants addresses the other giving direction on what he/she should or shouldn't do.
- Asking (ASK): One of the participants addresses the other asking for directions.
- Imitative (IMIT): One of the participants acts according to his or her own silent observation of the other's actions.
- None (NONE): There was no apparent communication between the two participants, excluding the silent observation by the Uninformed participant of the Informed one.

In addition, the qualitative analysis was mediated by a short informal debriefing session regarding the participants' feelings about the game (e.g. Was it fun? Did you understand the rules? Why did you win?).

Results

The quantitative analysis of observable behaviors concerned the comparison between the three groups of participants (Group Variable, Three Levels: Early Elementary, Late Elementary, and Adult) and the two categories of games (Game Variable, Two Levels: Cooperative and Competitive).

Table 1 Distribution of results to the question “Do participants communicate before playing?”

Do participants communicate before playing?										
COOPERATIVE					COMPETITIVE					
<i>Pulling</i>					<i>Opening</i>					
	Early	Late	Adult	SUM		Early	Late	Adult	SUM	
YES		1	5	8	14	YES	0	6	8	14
NO		7	3	0	10	NO	8	2	0	10
<i>Fishing</i>					<i>Towering</i>					
	Early	Late	Adult	SUM		Early	Late	Adult	SUM	
YES		1	4	8	13	YES	0	3	8	11
NO		7	4	0	11	NO	8	5	0	13
TOT	YES = 2	YES = 9	YES = 16			TOT	YES = 0	YES = 9	YES = 16	
	NO = 14	NO = 7	NO = 0				NO = 16	NO = 7	NO = 0	

Table 2 Distribution of results to the question “Who communicates first, if any?”

Who communicates first, if any?										
COOPERATIVE					COMPETITIVE					
<i>Pulling</i>					<i>Opening</i>					
	Early	Late	Adult	SUM		Early	Late	Adult	SUM	
INFOR		1	6	7	14	INFOR	2	3	8	13
UNINFO		0	2	1	3	UNINFO	1	3	0	4
NO		7	0	0	7	NO	5	2	0	7
<i>Fishing</i>					<i>Towering</i>					
	Early	Late	Adult	SUM		Early	Late	Adult	SUM	
INFOR		1	3	7	11	INFOR	1	3	8	12
UNINFO		1	5	1	7	UNINFO	1	2	0	3
NO		6	0	0	6	NO	6	3	0	9
TOT	INFOR = 2	INFOR = 9	INFOR = 14			TOT	INFOR = 3	INFOR = 6	INFOR = 16	
	UNINFO = 1	UNINFO = 7	UNINFO = 2				UNINFO = 2	UNINFO = 5	UNINFO = 0	
	NO = 13	NO = 0	NO = 0				NO = 11	NO = 5	NO = 0	

INFOR The informed participant; *UNINFO* The uninformed participant; *NO* No one

We compared the variables regarding the communicative behaviors before the official start of the game (see Table 1) and who initiated communication during the span of the entire session (see Table 2).

In order to assess potential differences among the three groups of participants regarding the question “Do they communicate before starting the game?” we analyzed the cumulative data. This means that we did not consider the distinction between Cooperative and Competitive games, nor the distinction between the different games within a given category (Table 3). The frequency data, analyzed by means of a Contingency table, resulted in a significant difference between the three groups (Chi-square 56,37: df 2; p -value < 0.0001). The following post-hoc Fisher’s exact tests comparing Early vs. Late, Late vs. Adults, and Early vs. Adults all turned out to be significant (p < 0.0001).

On the contrary, there was no significant difference between the variable Games (Cooperative and Competitive)

when analyzed across specific games and groups of participants: Cooperative YES = 27, NO = 21; Competitive YES = 25, NO = 23; Fisher exact test, p value = 0.8378.

The second quantitative comparison concerned the data relating to “Who communicated first, if anyone?”. Again, we compared the groups across tasks (see Fig. 2) and found that the Contingency Table analysis resulted in a significant difference between the three groups (Chi-squared 62,88; df 4: p < 0.0001), as well as a significant difference of the post-hoc comparison between groups (Early vs Late p < 0.0001; Late vs Adult p < 0.001; Early vs. Adult p < 0.002). The comparison between Cooperative and Competitive Games resulted in no significant difference (Chi-squared 0.8398; df 2; p -value 0.657).

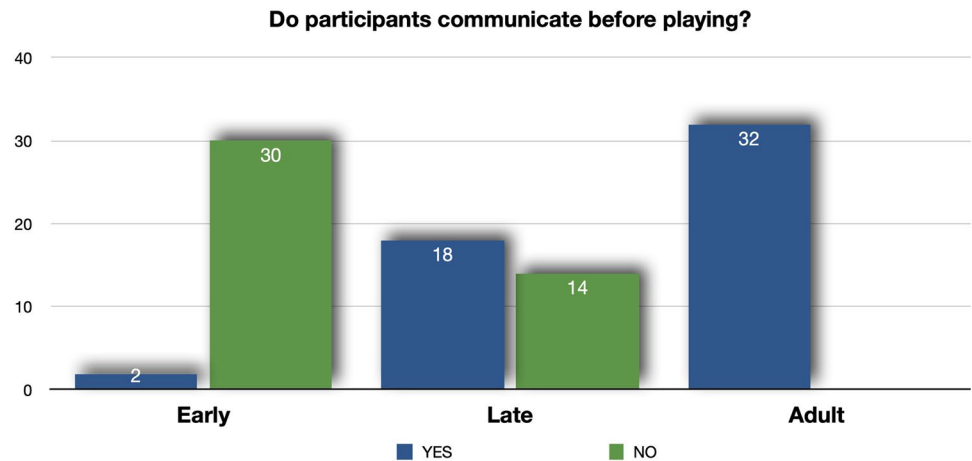
The last analysis of the participants' performance was qualitative and concerned what type of behavior was exhibited by the participant who “communicated first” (Fig. 3).

Table 3 Distribution of results to the question “What kind of communication occurred first?”

COOPERATIVE				COMPETITIVE			
<i>Pulling</i>				<i>Opening</i>			
	Early	Late	Adult		Early	Late	Adult
COND	1	3	5	COND	1	2	8
IMPER	0	2	2	IMPER	1	1	0
IMIT	5	2	0	IMIT	4	2	0
ASK	0	1	1	ASK	1	3	0
NONE	2	0	0	NONE	1	0	0
<i>Fishing</i>				<i>Towering</i>			
	Early	Late	Adult		Early	Late	Adult
COND	1	2	3	COND	1	2	8
IMPER	0	3	5	IMPER	0	1	0
IMIT	1	0	0	IMIT	6	3	0
ASK	1	3	0	ASK	1	2	0
NONE	5	0	0	NONE	0	0	0

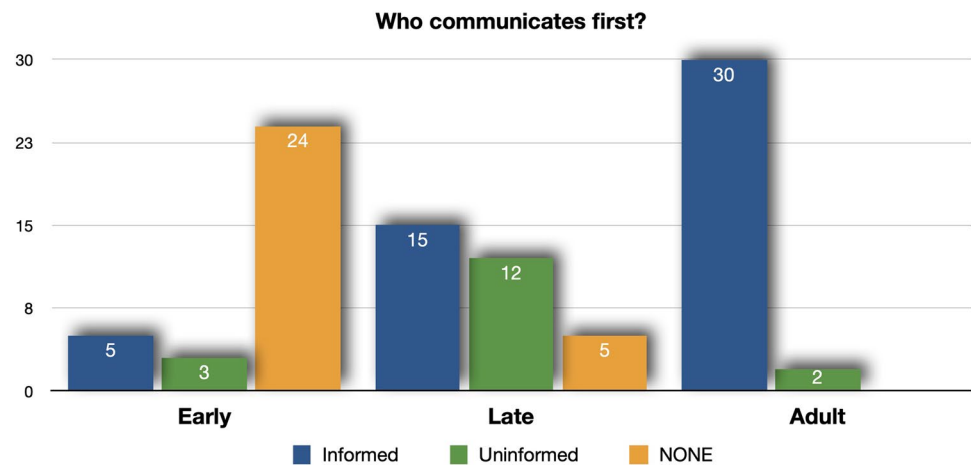
COND One of the participants addresses the other with the intention to share some content; *IMP* One of the participants addresses the other giving direction on what he/she should or shouldn't do; *ASK* One of the participants addresses the other asking for directions; *IMIT* One of the participants starts according to her / his silent understanding of the other's intentions in action; *NONE* There were any apparent communications between the two participants, exception made of the silent observation by the uninformed participant of the informed one

Fig. 2 Graph of the comparison between groups with respect to the question “Do participants communicate before playing?”, grouping Cooperative and Competitive games



	Frequency	
	YES	NO
Early	2	30
Late	18	14
Adult	32	0

Fig. 3 Graph of the comparison between groups with respect to the question “Who communicates first?”



Frequency

	Informed	Uninformed	NONE
Early	5	3	24
Late	15	12	5
Adult	30	2	0

Adult behaviors

All Adults exhibited a Communicative behavior for both kinds of games Competitive and Cooperative. The communication was mostly declarative and sometimes imperative. There was only one case in which the Uninformed participant asked “What should we do?” before the Informed participant had time to speak. An interesting observation of the Adult behavior in cooperative tasks was that, in some cases, the communication started with an Imperative tone, and in a few of those cases continued with this tone until the accomplishment of the goal (see supplementary material Video 3). In such situations, as emerged in the debrief session, the Informed participant thought it simpler to give direction immediately to the partner before informing him of the rules and target of the game. This was never the case for competitive games, where the Informed participants always used collaborative (COND) communication.

Late elementary children

All pairs of Late Elementary children exhibited some kind of interaction. Some interesting cases occurred in which imitative behaviors initiated the communication between the two participants, diverging from the observed Adult behavior. For example, the Informed participant started to play with the objects without much attention to the Uninformed participant; the latter, without asking, started to imitate the Informed participant.

Interestingly, there were three cases in the Towering game where the Uninformed participant imitated the Informed participant's behavior, “helping” him to build the tower instead of competing by building his or her own tower. In two of these three cases, the Informed participant did not “correct” the action of the other, but allowed the Uninformed participant to help. At the end of the game, smiling, the Informed participant received the reward while the Uninformed participant did not and even acknowledged that he won since the other participant did not know the rules (see supplementary material video 9). In the third case, the Informed participant shouted at the Uninformed participant, “Make your own over there!”.

Early elementary children

Early Elementary children were the only group in which no manifested communication patterns could be observed. This was particularly evident in the Fishing game where we realized, in hindsight, that the nature of the game made it difficult for the Uninformed participant to join by simply imitating the Informed participant. In this case, the tools available for the activity did not allow the Uninformed participant to act without interfering with the actions of the other child (see supplementary material video 2). In one case, a child tried to mimic the fishing behavior of the other participant using only his body and hand. Indeed, imitation was the most frequent behavior observed among this group in all of the other three games as well. Notably,

by using imitation, players were able to coordinate their actions in reaching the same goal in the Pulling Rope game. In the Towering game, the observed behavioral patterns were similar to those seen in the Late Elementary group—imitation sometimes led to helping the other build the tower instead of building his or her own.

Discussion

Of particular importance is that children 5–6 years of age (Early Elementary) who received the instructions about the game almost never informed the other participants about the rules or the reward. In both competitive and cooperative games, they immediately manipulated the objects in an attempt to pursue the goal. The Uninformed Early Elementary participants exhibited communicative behaviors before their Informed counterparts, mainly through gestures, but also verbally. This pattern was evident in all the games except the Fishing game, which we attribute to the fact that this game did not permit the Uninformed participant to take an active role or use any effective gestures. It appears that even if the Uninformed participant initiated the communication verbally, it was not enough to prompt the Informed participant to reciprocate any significant communication. As seen in the other games which did permit the Uninformed participant to take an active role (see the Rope, the Boxes, and the Tower), their initiating behavior was promptly acknowledged by the Informed participant and led to further interaction. This result was quite unexpected, especially in comparison with what happened with the Rope game, where the Informed Child even without talking coordinated her/his behavior with the Uninformed participant. It seems that explicitly involving the other child in the game was much more difficult than accepting his proactive behavior. Perhaps this would require, for the Informed child, to redefine the shared ground that was adopted when he started the game. We have to consider that the Informed child was “cooperating”, but with the Experimenter who gave the child the rules of the game that no Informed child ever violated. Maybe the task of sharing the rules with the other child was too demanding for the child who preferred to go alone. But this hypothesis needs its own research.

In direct contrast with the Informed participants of the Early Elementary group, Informed Adults exhibited a constant Communicative behavior by briefing the Uninformed participant before starting each respective game. Interestingly, constant communication was equally observed in both types of games, competitive and cooperative. Communication initiated by the Informed participants was mostly declarative, aimed at sharing the constitutive rules of the game, its goal and reward. In a few cases,

the participants even reset the game and agreed to a new starting point, communicating exactly how and when they were to re-start; for example, one group stated: “1, 2, 3 then we start at the GO.” However, in some cases, and seen more often in cooperative games, communication had an imperative tone. In these cases, the Informed participant dictated instructions to the Uninformed participant who readily consented to carry out the given orders. For example, in the Fishing game, the Informed participant handed the rod to the other participant and brusquely gave instructions on how the pair would proceed, a strategy that produced effective results in terms of time execution and communicative concision. Overall, the behavior of adults was characterized by a declarative communication style, even if it had periodic tones of imperativeness.

The Late Elementary group (8–10-year-olds) displayed a more varied pattern of results, presenting a combination of features seen in the other two groups. The group exhibited a Communicative behavior for all the games similar to what was observed in the Adult group. However, like the Early Elementary group, the behavior of Late Elementary participants was often initiated by the Uninformed participant rather than by the Informed one. Interestingly, the initial communication usually occurred after the Informed participant began to manipulate the objects of the experimental setting, a behavior that was also observed in the Early Elementary group.

The most telling observations in attitudes between Informed and Uninformed Late Elementary children are as follows: i) offers of help in the Fishing game were exhibited by the Uninformed participants and often neglected by the potential partners; and ii) the willingness of the Uninformed participant to collaborate in the Towering game was, more often than not, “exploited” by the Informed participant. It is worth mentioning that three out of the four Informed children who accepted the help of the Uninformed participant without communicating the rules of the Towering game, responded to the debriefing session question, “How is it that you won?” in a similar way: “Because he/she did not know the rules!”.

Also for the Late Elementary group, it seems that the more relevant shared ground adopted to guide the behavior of the children is the one between the child and the Experimenter who provided the rules of the Game. Indeed as well as for the Early Elementary group, the rules were never violated. However, for this group, it is possible to observe a trend toward the sharing of the rules, in some cases due to spontaneous behavior and in other cases when prompted by the behavior of the Uninformed participant. Interestingly enough is the fact that in the Competitive game the Informed participant did not consider it unfair not to share the rules with the Uninformed participant since this was a condition foreseen by the “rules”.

In summary, the significant differences regarded the three groups but not the type of games. This was unexpected, it seems that more than the potential nature of the activity, competitive vs cooperative, what mattered was the attitude to extend or create a shared ground. The Informed participants of the Early Elementary group just exploited the attitude of the Uninformed participant to establish or consolidate her/his shared ground, insofar as the condition of the game allowed the Uninformed an active participation based mostly on imitation (e.g. the Rope, the Box and the Tower). For the Fishing game instead, it was more difficult to join in the activity without knowing the rules. Concerning this game the more surprising result was the lack of willingness of some of the Late Elementary participants to share the rule or receive help from the Uninformed participant. A possible explanation can be found in the debrief session where one of the children said he saw this as a personal challenge, he would like to show that he could get the reward by himself. This made us ponder on the way in which the instruction "... It is up to you to decide if and how to involve him/her in the game" could have been interpreted by the child.

Conclusion

We set up an experimental study in order to empirically address the relationship between the two forms of human intentionality, We and I, as exhibited during the early stages of human development. Our intent was exploratory, also considering the peculiar experimental design (i.e. the communication patterns as dependent variables; the asymmetric instructions given to the participants.) Taking into account such exploratory nature, our primary objective was not to prove a theory but rather to gather information, identify patterns, and formulate research questions or hypotheses for further investigation.

The obtained results seem to be in favor of a hypothesis of a developing and indivisible relationship between the two forms of intentionality. Humans are born with the potentiality for both forms of intentionality, with each one playing a specific role in the relationship we have with our social and physical environments. The We-intentionality establishes the common ground within which the I-intentionality manifests itself. Changes in the common ground dramatically change the value and meaning of an individual intention. Therefore, we are in constant search of a shared ground within which to produce and make sense of our individual intentional actions. The relationship between the two is subject to a process of sociocultural evolution, which is responsible for the fine-tuning of both of these roles (see also Grueneisen and Warneken, 2022).

For example, by watching the Informed participants' actions, the Uninformed Early and Late Elementary

participants tried to discover the potential We-intentionality within which to move. No participant ever tried to establish an individual activity disjoined by the other participant, even despite a lack of response from the potential mate. Instead, the Uninformed participant exhibited gestures of support toward the Informed participant. The Informed Early and Late Elementary participants had created a We-intentionality with the experimenter prior to the start of the game, allowing their I-intentionality to drive their decision on whether to involve the Uninformed participant or not. This could be the reason for the complete lack of communication before the game started for the Early Elementary group, common to all games no matter if potentially competitive or cooperative. They had their Shared Intentionality with the Experimenter, indeed no one of the children ever tried to violate the given rules, in any of the conditions. So, in some sense, they exhibited cooperative behavior, but with the Experimenter more than with the other child. On the contrary, the Uninformed children were still looking for what to do.

It could be argued that the Uninformed participant had expectations of a possible joint activity since he/she had been called to participate in something even though he/she did not know the details or purpose. But this is just the point – why does one expect a joint activity? And more importantly, why are we so willing to extend our help even if the circumstances fall short of our expectations? On the other hand, if we have the chance, why do we choose not to involve others, especially when it would clearly be to our benefit?

Obviously, the results of the experiment can be explained in various ways and are far from conclusive. Nevertheless, congruent with the research completed on Shared Intentionality (Tomasello, 2010, Rakoczy, 2017), we can suggest the following:

A) I-intentionality does not disappear, nor do other elementary forms of cognitive processes. Instead, remaining at the base of a dyadic relationship with the environment, the I-intentionality develops and operates in constant relation to the We-intentionality, even in the absence of a mate.

B) The two forms of intentionality are constantly co-present in our involvement with the world, giving rise to a unique condition of intentional relationship with the world. We have the ability to: i) "see" the world from multiple points of view, i.e. in first and second person (expression of dyadic representations of individual intentionality); ii) modulate both points of view according to what specific We-intention we are willing to build and adapt to (an expression of the interdependence of the two forms of intentionality); and iii) build syncretic representations of these points of view, that is, points of view in the third person (expression of Shared Intentionality).

Yet, the ability to manage the interplay between the two forms of Intentionality is not something we get for granted as

the Shared Intentionality manifests itself around the second year of life. The relationship between the two forms of intentionality needs to be refined along with our development. For example in deciding with whom to share intentions, or how affordable can be extending the shared playground. We think it is this interplay that would enable individuals to engage in cooperative behaviors, coordinate actions, and understand each other's intentions within a shared social context or not. It highlights the crucial role of social interaction in shaping our cognitive processes and shaping our understanding of the world but at the same time points up the more individualistic attitude in games as well in other interactions. Our findings are preliminary and should be interpreted as such. We hope they could serve for promoting discussion and more rigorous research about the relationship between the two forms of human intentionality.

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Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request. A sample of the raw data is provided in the supplementary material.

Declarations

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee for Research in the Human and Social Sciences of the University of Siena. This research does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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