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Distinguishing three levels in explicit self-awareness

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ABSTRACT

This paper focuses on the development of explicit self-awareness in children. Mirror self-recognition has been the most popular paradigm used to assess this ability in children. Nevertheless, according to Rochat (2003), there are, at least, three different levels of explicit self-awareness. We therefore designed three different self-recognition tasks, each corresponding to one of these levels (a mirror self-recognition task, a picture self-recognition task and a masked self-recognition task). We observed a decrease in performance across the three tasks. This supports a developmental scale in self-awareness. Besides, the masked self-recognition performance makes it possible to assess the final and the most sophisticated level of self-awareness, i.e. the external self. To our best knowledge, this task is the first attempt to evaluate the external self in preverbal children. Our results indicate that 22-month old children show awareness of their external self or, at least, that this ability is in the process of being acquired.

1. Introduction

What is it meant by "self-awareness"? Throughout history, mankind has always been confronted with identity-related questions such as "Who I Am?", "How do I know who I am?", "Do others perceive me the same way as I do?", "Do I remain the same whereas my appearance changes?". However, despite the central interest of these issues, the self remains an elusive concept with a multiplicity of definitions (*e.g.*, Cicchetti & Beeghly, 1990; Epstein, 1973; Lewis, 1994; Neisser, 1993; Parker, Mitchell, & Boccia, 1994; Rochat, 1995; Snodgrass & Thompson, 1997; Stipek, Gralinski, & Kopp, 1990).

Self-awareness can be defined as involving expert knowledge of oneself as a defined entity, independent of others individuals, unified, consistent and stable over time and space. Self-awareness further allows one to be the subject of one's own attention.

Moreover, self-awareness should not be viewed as an all-or-none phenomenon but should rather be conceived as a complex ability that spans several levels. According to James (1890), there are at least two fundamental and interrelated levels of the self. The first level is the "*I*", the implicit level, at which the self is merely a subject of experience. The second level is the "*me*", the explicit level, at which the self has become an object of knowledge for oneself. In this model, self-awareness begins a long time before the onset of self-recognition and is later included in the "*I*", the implicit self. This kind of self is very different from the one that emerges in the middle of the second year of life, the "*me*" (for a discussion, see Lewis, 1994). The "*me*" is an explicit and conscious idea of the self; it allows the self to become the subject of one's own attention.

Rochat (2003) also defends the idea that self-awareness is not singular, but multiple. He claims that its development is a continuous and dynamic process that can be divided into five gradual levels. These five levels can be easily integrated in both facets of self-awareness. The "*I*" is composed of the two first implicit levels and the "*me*" comprises the final three explicit

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levels. Since our study focuses on explicit self-awareness, we will only discuss the three levels of self-awareness in Rochat's model. The first level is the *identified self*. At this level, the individual recognizes himself in the mirror and the link between the self as experienced from within and what is displayed on the mirror is built. The *permanent self* is the second level. The self is specified beyond 'the here and now' of the mirror experience, the child's self is not tied to the present time anymore. The child has grasped the continuity of its own self and is now able to realize that his self remains the same over the course of time. Finally, at the third level, one is not only aware of who one is but also of how others perceive us. We propose to label this final stage, *the external self*, as the child becomes aware of how he is perceived by other individuals. At this stage, he is also aware that this external self can evolve or can be modified even though no changes occur at a deeper level of his self. The child realizes that his own "being" differs from his own "seeming". Note that we focus on the distinction between appearance and reality of its own experience only and that we are not yet at the stage of the more general distinction between appearance and reality of the objects as developed by Flavell (1986).

As the previous discussion indicates, self-awareness cannot be reduced to a monolithic ability. Rochat's model allowed us to identify three levels of the explicit self-awareness in the developmental sequence. How could one assess each level individually? To address this issue, we used, as detailed below, three different tasks to measure each level of the explicit self: a mirror self-recognition task, a picture self-recognition task and, finally, a self-recognition task on pictures wearing a mask.

In contrast to our research strategy, studies on self-awareness have essentially been limited to the mirror task, developed 40 years ago by Amsterdam (1972) and Gallup (1970) to assess self-recognition in children and animals. The experimental procedure consists in four steps. After a first period of mirror exposure, the subject's forehead is surreptitiously marked with a red mark. A control period, during which the mirror is not visible, ensures that the subject does not feel the red mark or that he does not touch his forehead by accident. Finally, the subject is again presented with the mirror. Most animals have social behaviors in front of their reflection, with only apes show a positive mark-directed response (*e.g.* Anderson, 1984, 1994; Gallup, 1970, 1998; Gallup & Suarez, 1991; Gallup, Anderson, & Shillito, 2002). Human studies have shown that children are able to recognize themselves from 18 to 24 months onwards (*e.g.* Amsterdam, 1972; Asendorpf, Warkentin, & Baudonniere, 1996; Bertenthal & Fischer, 1978; Bigelow, 1981; Bullock & Lutkenhaus, 1990; Johnson, 1983; Lewis & Brooks-Gunn, 1979; Lewis, Brooks-Gunn, & Jaskir, 1985; Nielsen, Dissanayake, & Kashima, 2003; Schulman & Kaplowitz, 1977).

Even though there is a broad consensus to recognize that the achievement of mirror self-recognition is an important developmental milestone in the second year of life (*e.g.* Anderson, 1984; Asendorpf & Baudonniere, 1993; Bertenthal & Fischer, 1978; Butterworth, 1992; Gallup, 1982; Kagan, 1981; Lewis, 1994; Neisser, 1993; Povinelli, 1993, 1995; Rochat, 1995), the meaning of mirror self-recognition as a marker of self-awareness has not gone unchallenged. Indeed, other interpretations of the mirror response have been proposed that do not require the subject to have explicit self-awareness. For instance, a mere understanding of the perfect contingency between the specular image and the real world might be sufficient to account for the observed behavior. Likewise, kinetic or body awareness may also explain subjects' reaction in front of the mirror without necessarily involving their ability to recognize themselves. These alternative interpretations do not relate to mental representations and do not mandate the concept of self-awareness (*e.g.*, Anderson, 1984; Bard, Todd, Bernier, Love, & Leavens, 2006; Courage, Edison, & Howe, 2004; Gallup, 1998; Heyes, 1998; Loveland, 1986; Mitchell, 1993, 1997; Povinelli, 1995, 2001; Povinelli & Cant, 1995; Rochat, 2003; Suddendorf & Whiten, 2001; Suddendorf, Simcock, & Nieslen, 2007).

However, several studies also show that passing the mirror task implies more than kinetic or body awareness. For instance, children who pass the mirror task exhibit self-conscious emotions (such as pride or embarrassment), while those who fail the task do not exhibit such emotions (Bertenthal & Fischer, 1978; Lewis, 1992; Lewis & Brooks-Gunn, 1981; Schulman & Kaplowitz, 1977). Further, one study (Keenan, Wheeler, Gordon, & Pascual-Leone, 2000) has indicated that the brain regions that are active during mirror self-recognition are similar to the brain areas activated in other self-related processes such as autobiographical and introspective processing.

Therefore, it seems that mirror self-recognition task may be a measure of an early component of self-awareness but it should not, on any account, be considered as an exhaustive and exclusive test of self-awareness (Povinelli, 2001). Nevertheless, this task remains an excellent way to assess the first level of explicit self-awareness and, for this reason, we used the mirror task to assess the identified self.

How can we best assess the two other levels of self-awareness: the permanent self and the external self? We suggest that self-recognition on pictures can be used to assess the permanent self. Indeed, at this level, children have a sense of psychological continuity over time and space. Thus, children should be able to recognize themselves on a picture that was taken some days before the test. Children are no longer dependent on the present time and are able to recognize themselves out of the here and now of the mirror experience. To pass this test, children have to be familiar with their appearance. They have to be able to distinguish their own picture from other familiar children. Previous studies have shown that picture self-recognition was more difficult than mirror self-recognition (*e.g.* Courage, 2004; Lewis & Brooks-Gunn, 1981). Picture self-recognition could thus be an appropriate way to test the second level of self-awareness development; the permanent self.

Turning now to the external self, to the best of our knowledge, this level has never been assessed in preverbal children. Finding a way to assess this level of self-awareness that does not involve complex verbal instructions therefore constitutes one of the main goals of this study. Indeed, the final level of Rochat's model is more complex than the others since it is not only related to the self, but also to the external self, that is, the self as it is perceived by others. Its assessment seems commensurably more difficult. How can we assess the way a child imagines he is perceived by others? Some existing self-awareness scales appear to be relevant at first sight (Fenigstein, Scheier, & Buss, 1975; Scheier & Carver, 1985; Semerari et al., 2003). These scales, however, are based on a series of verbal questions and, for that reason, cannot be used with young

children. The assessment of this ultimate level of self-awareness is also made difficult by the fact that, most of the time, *being* can be confused with *seeming*. Indeed, in most cases, both concepts overlap with each other. In others words, it is difficult to assess awareness of the manner others perceive us because the perception that we have of our own appearance is the same as the perception that others have of us.

According to Rochat's model, children who are self-aware at this final level should be able to represent themselves in relation to past and present events. They should also be able to think about themselves through the eyes of somebody else. In this light, we surmise that changing the appearance of a child at the time he is photographed is perhaps one way to disentangle "seeming" and "being".

At the same time, we used animal masks to change the children's appearance in our study. In this way, the child cannot recognize his own picture based on his familiar face features anymore. To pass this task, he not only has to differentiate his "being" from his "seeming", but he also (1) has to possess the ability to represent himself in relation to a past event and (2) possess the ability to be aware of his external aspect and of the manner through which he is perceived by others. We discuss later in the results section how we control for mask familiarity so that children performance in this task truly reflects self-recognition rather than mere recognition of the mask.

To summarize, our three tasks should allow us to track the developmental course of self-awareness. Indeed, if the hypothesis that there is a correspondence between our three tasks and the three levels of Rochat's model is correct, we should observe that performance increases across the three tasks with development. Thus, most children should succeed at the mirror task, which measures the first level of explicit self-awareness. Some children should succeed in the picture recognition and in the mask tasks, which respectively assess the intermediate and most complex (the external self) levels of the explicit self-awareness, but crucially, we do not expect children to succeed in these latter tasks after having failed the mirror task. Likewise, we do not expect children who fail the picture task to succeed at the mask task.

2. Method

2.1. Participants

Twenty-eight children (17 males) aged 22–32 months (M = 27.7 months; SD = 2.83) took part in our study. Three children have been excluded from the analyses because they did not perform all three tasks. All parents offered written consent for the participation of their child in the study.

2.2. Procedure

Observations were conducted in a quiet room of a daycare center. The experimenter first read a little story as warm-up, and the testing began once the child seemed at ease with his surroundings and with the experimenter. Children were tested individually and the entire experimental procedure was videotaped. Children's behavior and responses were analysed by two independent observers working with the recorded material.

Each child took part in each of the three tasks assessing different stages of self-recognition: the mirror task, picture self-recognition and self-recognition on a picture wearing a mask.

2.2.1. Mirror self-recognition task

The mirror task consisted in four distinct stages. (1) The child sat in front of a medium sized mirror (130 cm $\times$ 40 cm) in which he could see himself from head to foot. The experimenter remained on one side of the mirror in such a way that she did not appear in the mirror. The experimenter encouraged the child to look in the mirror if he did not do so spontaneously. However, the experimenter never used the word "mirror" nor called the child by name. After 30 s, the mirror was covered. (2) In the second stage, the experimenter surreptitiously put a colored sticker on the child's forehead. To make sure that the child did not notice the sticker, the experimenter read a story for a further 60 s. If the child reached for the sticker within this period the task was not administered. (3) If the child did not respond to the sticker within the 60 s story period, the mirror was uncovered and the child was again given 30 s of mirror exposure. If the child reached for the sticker or for a surrounding region (a circle of about 5 cm centered on the sticker), the trial was considered to be successful. If after 20 s of mirror exposure, the child did not react spontaneously, the experimenter told him, without looking at the sticker, "Remove this!". This was done to dismiss the possibility that the child noticed the sticker but did not dare to touch it. At this point, the response was considered correct. If the child did not react after another 10 s, the trial was classified as a failure.

2.2.2. Picture self-recognition task

A picture of the child was taken between 1 and 3 days before the test was administered.

2.2.2.1. Pre-test. Four pictures of familiar objects were put in front of the child. Then, the experimenter asked him to point to one of the pictures ("Where is the car? Show me where the car is"). This was done two times and ensured that the task was properly understood by the children and that they were willing to participate.

2.2.2.2. Test. Four different pictures of a child's face were put in front of the child (three pictures of familiar children and one picture of the child himself). The experimenter then asked "Where are you? Show me where you are". We took care to never use the word "picture" (which could facilitate the task) or the child's name. The use of the child's name does not necessarily probe self-recognition. Indeed, the child could learn to associate name and facial features without being aware that they belong to him (Povinelli, 1995, 2001). To avoid the possibility that the child responds correctly without understanding the link between his picture and himself, we preferred to use the personal pronoun 'you', which is more directly linked to the self.

The three other pictures were carefully chosen amongst the children who were in the same nursing group and looked like the participant as much as possible (same skin color, same gender, same hairstyle). In order to avoid language, our dependent measure was the observation of a pointing movement to the correct picture. In order to decrease the possibility that correct choices may result from chance, the task was administered twice. Thus, scores range from 1 (the child recognized himself twice), 0.5 (he recognized himself only once) or 0 (both trials were unsuccessful). Each response was therefore considered as a success or failure and one correct response was not sufficient to consider that the child was able to recognize himself.

2.2.3. Mask self-recognition task

Between 1 and 3 days before the task was administered, three children were asked to play a game with masks. On this occasion, the experimenter put a different animal mask on each child's face, and a picture of each child wearing the mask was taken. Children were subsequently given the opportunity to look at themselves in the mirror during 60 s. In order to control for the masks' familiarity, three children participated at the same time. In this way, the familiarity of all three masks was exactly the same for each child. The constitution of the groups was not based on any selection criterion. As children attended the same daycare center, they were all familiar with each other.

2.2.3.1. Pre-test. As for the picture self-recognition task, four pictures of familiar objects were presented to the child and the experimenter asked him to point a particular object.

2.2.3.2. Test. Four pictures of a mask were put in front of the child: the picture of the mask that the child had worn, pictures of the two other masks worn during the exposure period, and a picture of new mask. This new mask was used to control for the effect of mask exposure. As in the picture self-recognition task, the experimenter asked to the child "Where are you? Show me where you are". The child succeeded the task if he pointed to the picture of the mask that he worn. As in the picture self-recognition task, to rule out the possibility that correct choice result from chance, this task was administered twice. Children's scores could thus range from 0 to 1, as for the self-recognition task.

2.3. Scoring

All sessions were videotaped and coded by two independent observers. Given the unequivocal nature of the children's responses, observer inter-reliability was 100%. Note, however, that children's responses were occasionally ambiguous, either because he had pointed to a picture before the experimenter asked the question "Where are you? Show me where you are?", or because he pointed to several pictures. In such cases, the experimenter took back the pictures and said "Wait, we'll start again and you'll show me where you are!". The experimenter then shuffled the four photos and replaces them on the table once again. The child's response was then recorded, regardless of whether it differed or not from the previous answer.

3. Results

In a first series of analyses, we computed the number of correct responses obtained in each of the three tasks. We then measured the probability of passing the picture recognition while failing the mirror recognition task and the probability of passing the mask task while failing the mirror or picture recognition task.

3.1. Percentage of correct responses

In line with previous studies (Courage, 2004; Lewis & Brooks-Gunn, 1981), we observed a high success rate in the mirror self-recognition task (93%) and a slightly lower success rate in the picture self-recognition task (84%). Self-recognition wearing a mask was successfully passed by only 62% of children (see Fig. 1). The error bars do not show a significant difference in the success rate between the mirror self-recognition and the picture self-recognition. The only significant differences are observed between these two tasks and self-recognition wearing a mask.

Note that self-recognition was close to ceiling for the mirror task. This is not surprising as this task is normally passed successfully at around 18–24 months of age (*e.g.* Amsterdam, 1972; Asendorpf et al., 1996; Bertenthal & Fischer, 1978; Bigelow, 1981; Bullock & Lutkenhaus, 1990; Johnson, 1983; Lewis & Brooks-Gunn, 1979; Lewis et al., 1985; Nielsen et al., 2003; Schulman & Kaplowitz, 1977).

Data were not normally distributed and the requirement of the homogeneity of variances was not met between the three tasks. We therefore used non-parametric tests for data analysis. We used a Friedman tests to compare performance between our three tasks. Then, we used Wilcoxon tests to compare the tasks pair-wise. Mann–Whitney non-parametric tests were

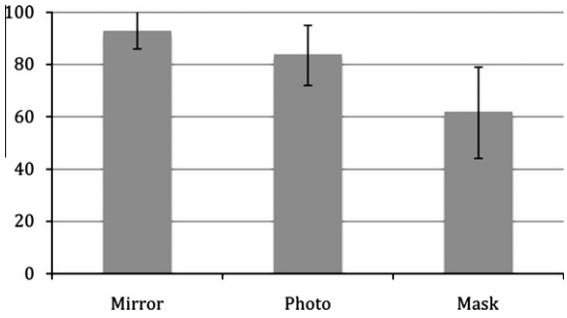

Fig. 1. Percentage of correct responses in the three self-recognition tasks. Error bars represent the confidence interval of the mean at 95%.

used to compare scores within groups. For instance, to compare the performance of the older children with the performance of the younger ones. The median was always used to define the groups for within-group comparison. χ^2 tests were used to compare frequencies. A criterion of .05 was used in all analyses.

Sex did not influence performance in any of the three self-recognition tasks (Mann–Whitney $U = 90.50$, $p = .752$ for the mirror task, $U = 89.50$, $p = .804$ for the picture task and $U = 85.50$, $p = .677$ for the mask task). The effect of age has been independently calculated for each of the three tasks. We observe a significant effect of age in the mirror self-recognition task ($\chi 2\ (2) = 6.231$, $p = .044$) and a marginal effect of age was observed in the picture self-recognition task ($\chi 2\ (2) = 5.033$, $p = .081$). In both tasks, performance improved with age. Even though the oldest children were the most successful in the mask task (the five 32-month old children made only one error), in contrast to the other two tasks, self-recognition wearing a mask was not reliably affected by age ($\chi 2\ (2) = 1.364$, $p = .505$).

A Friedman test revealed that the number of correct responses differed significantly between the three tasks ($\chi 2\ (3) = 12.047$, $p = .002$). A Wilcoxon test further indicated that mirror self-recognition was significantly better than self-recognition wearing a mask ($Z = -2.600$, $p = .009$). A similar test also indicated that picture self-recognition was significantly better than self-recognition wearing a mask ($Z = -2.364$, $p = .018$). No significant difference was observed however between mirror self-recognition and picture self-recognition ($Z = -1.667$, $p = .096$).

To determine whether or not there was a scalable order of three different components of explicit self-awareness, we considered the patterns of success and failure on the three tasks. Eight such patterns are possible (see Table 1). The first three patterns in Table 1 correspond to a developmental tendency across the three self-recognition tasks. To assess this sequencing, a Green's scalogram analysis was performed (Green, 1956). The scalogram analysis, which requires dichotomous items, is designed to determine whether success patterns are scalable or homogenous. In other words, the method makes it possible to assess whether different items (here, the success rates of our different recognition tasks) are independent from each other or related in such a way that failure on one task tends to be followed by failure on the subsequent tasks rather than by successes. Such a tendency is given by the *index of consistency* (*I*) which takes the value of 1.0 if the items are perfectly scalable and has an expected value of 0.0 when the items are completely independent. It is usually considered that *I* should be 0.50 or more for scalability, that is, for the interference that the different items taken into account are located on a scale. This analysis also makes it possible to assess the coefficient of reproducibility, which measures the extent to which the respondent's success on the items can be reproduced from the relationship that defines a perfect scale, where a value greater than .50 indicates scalability.

Using this method, we obtained an index of reproducibility equal to 0.98 and an index of consistency *I* of 0.81. This suggests that our tasks are effectively organized on a developmental scale that goes from mirror self-recognition, to picture self-recognition and, finally, masked self-recognition. Therefore, children who succeeded in the mask task are also more likely to pass the mirror and picture tasks. Likewise, those who pass the picture task are also those who were successful

Table 1
The different patterns of success and their observed distribution. In order to simplify the analyses, only a score of 1 was considered as success (a score of 0.5 was considered as failure).

	Mirror s-r	Picture s-r	Masked s-r	Observed values
Response patterns				
1	Success	Failure	Failure	4
2	Success	Success	Failure	8
3	Success	Success	Success	13
4	Failure	Failure	Failure	1
5	Failure	Success	Failure	0
6	Failure	Success	Success	0
7	Success	Failure	Success	1
8	Failure	Failure	Success	1

at the mirror task, but not necessarily the mask task. Note that the calculation of this developmental trajectory is based on the success rates in the three tasks and that, here, age was not directly taken into account.

In the mask task, we also observed that when a child chose one of the distractor masks, he opted, in most cases, for one of the masks that he had already seen during the play session. Only two out of the 13 children who failed the task, chose the new and unfamiliar mask. An adjusted Chi Square test confirmed that both kinds of error were not equally distributed ($\chi 2$ (1) = 6.231, p = .013). Indeed, errors were mainly due to the choice of an already seen mask. This suggests that children were effectively influenced by the familiarity of the masks, but such familiarity in and of itself cannot be the only basis of responding in this task. If performance were based exclusively on familiarity, children should be no more likely to indicate the mask that they were actually wearing than the other masks they had seen during the play session.

4. Discussion

In this paper, we investigated explicit self-awareness in children using three different tasks. Each task is supposed to assess a different level of self-awareness. The first of these tasks is mirror self-recognition. For different reasons discussed in the introduction, the mirror self-recognition task does not provide an exhaustive assessment of self-awareness. Therefore, we used three tasks, to obtain a better picture of self-awareness in our participants. Mirror self-recognition was used to assess the identified self; a picture self-recognition task was used to assess the permanent self, and the self-recognition task with a mask was introduced to assess the external self.

As expected in Rochat's developmental model, the results show a decrease in correct responses from mirror self-recognition to picture self-recognition and from this latter task to masked self-recognition. This increasing difficulty across the tasks is also is supported by the observed success patterns. The most frequent patterns correspond well to the expected developmental track. In other words, most participants who succeeded at the picture task also succeeded at mirror self-recognition, and most participants who succeeded at self-recognition wearing a mask also succeeded at the picture task.

It should also be noted, however, that we almost observe a ceiling effect in the mirror task. Testing younger children would involve the risk of a floor effect in the mask task. It would nevertheless be interesting to apply our three tasks to slightly younger children (between 16 and 26 months) so as to obtain midrange performance on the three tasks to discard the possibility that the ceiling effect in the mirror task affected the analysis of scalable order.

Even though these results suggest the existence of a developmental scale between the three tasks, alternative interpretations remain possible. For instance, the observed differences in success rates could be due not to a specific difference between levels of self-awareness but rather to differences in more general cognitive requirements. Indeed, the more complex skills tend also to be the more difficult to assessed. The possibility that the increasing difficulty of our three tasks is confounded with the level of self-awareness is real but inherent to the assessment of skills in development. Moreover, a similar issue arises when questioning the relevance and validity of the comparison between any three different tasks. To control for this potential confound as much as possible, we made both photos tasks as similar as possible by using the same procedure, the same instruction, and the same success criterion. Nevertheless, one might argue that while most children have a lot of experience with looking at themselves in the mirror or pictures (family pictures for example), they hardly have experience with looking at pictures of themselves disguised. We should then remain aware of the possible confound between the difficulty of the task itself and the level of self-awareness that we want to evaluate.

Differences in attentional ability may also be blamed for performance differences across our tasks. The picture task may require more attentional resources than the mirror task and the mask task may require more attentional resources than the picture task. The tasks requiring fewer attentional resources would simply be more easily performed than the more demanding tasks. However, contrary to the mirror task, the experimental design of the picture and mask tasks are very similar to each other. The experimental procedure and the question asked to children were further rigorously identical. Therefore, there is little reason to think that the amount of attentional resources required for successful performance differs between these two tasks.

Language proficiency could provide a second alternative explanation. Indeed, contrary to the mirror task in which no instruction is given, children have to follow verbal instructions in the picture and mask tasks. Obviously, to succeed at these tasks, children have to understand these instructions. We do not think, however, that the use of verbal instructions may explain the differences between the three tasks. We took care, before testing self-recognition, to ask children to point towards different familiar objects. Every child was able to understand these instructions, which are similar to those used in the self-recognition tasks, and to perform the pre-test successfully. Moreover, the fact that the picture task is performed significantly better than the mask task in spite of the fact that the instructions are exactly the same in both tasks ("Where are you? Show me where you are") does not segue fit with this alternative explanation.

Finally, memory may also have played a role in the pattern of results that we observed. Children have to remember their facial features or the mask that they had worn in order to perform the picture and mask tasks. This is an important caveat. In the following, we first discuss the role of familiarity with our own facial features and then the specific memory requirements imposed by the mask task. Concerning memory for one's facial features, we did not observe a significant difference between mirror self-recognition and picture self-recognition. The only significant differences were observed between these two tasks and self-recognition wearing a mask. This is suggestive that mirror and picture self-recognition are more related to each other than with the mask task. The mirror and picture tasks assess, each in their own way, one ability's to recognize the

familiar features of one's own face. These two tasks probe the association between some form of self-awareness and familiarity with his or her facial features. However, being aware of one's own appearance cannot be reduced to familiarity with one's facial features. Indeed, the faces of people whom we meet daily are more frequently seen and therefore likely to be more familiar than our own face. Despite this substantial difference in the frequency of exposure, we never confuse our own face with one of these people. Similarly, children are more familiar with the face of their parents or with the face of the other children they meet daily in the daycare center. In spite of this, very few children (16%) failed the picture task, even under the relatively difficulty conditions through which the distractor faces had been selected to be as similar as possible to the subject. This result is in line with other studies showing that our own representation in processed in a specific way (Devue & Brédart, 2008; Devue et al., 2007). It clearly follows from this argument that picture self-recognition task does not only assesses familiarity with certain facial features, but effectively constitutes one component of self-awareness.

Contrary to the mirror and picture tasks, in the mask task, recognition is not based on personal facial features but rather on recollecting the specific mask that was worn on a specific occasion. As the physical features of the mask are much less familiar than one's own face features, children may more frequently fail the mask task simply because they forgot the mask they had worn. Further analyses of the children's patterns of errors in the mask task suggest, however, that failure of memory is not the cause of the lower percentage of correct responses in this task. Recall that, during the pre-test, three children were simultaneously wearing a mask and looking at each other directly or through the mirror. These three masks were therefore familiar when presented at test. A picture of a new mask was also presented at test. Our analyses on error patterns showed that children choose one of the masks that they already seen more frequently than the picture of a completely unfamiliar mask—suggesting that they had some memory of the masks that had been used during the pre-test. This suggests that the source of failures in the mask task stems not from memory but rather from children's difficulty to associate a representation of their self and a representation of their external appearance. Indeed they had looked at each of the masks in the same way and for the same time, the only difference thus laying in personal experience. Thus to respond correctly, the child has to remember, among several possibilities, which mask he wore himself. He doesn't have to choose the most familiar mask, but rather the one that is specifically linked to him. Defective memory, therefore, cannot explain observed performance differences between the three tasks or failure in the mask task. We rather believe that failure in this latter task is due to a confusion between the mask that the child was himself wearing and the masks worn by the other children or, in other words, between his own appearance and the other children's appearance.

We did not precisely measure, however, where the child was really looking when he was facing the mirror along with two other children who were also wearing a mask. It may thus be the case that children look at themselves longer than at their peers. Even if it does not correspond to our subjective impression, it might be interesting to include an additional eye-tracking measure in a later study in order to rule out a possible bias due to looking time during this phase.

Note also that we did not observe a relationship between performance and the number of days between pre-test and test ($\chi 2\ (2) = 1.742$, $p = .187$). If memory abilities had an influence on performance, we should have obtained better results with shorter delays. This also runs counter alternative explanations based on memory.

We assume that the mental representations assessed through our three tasks are not situated at the same level of self-recognition. Namely, children who succeeded in the mask task are self-aware of their external self. They are aware that this external self (their "seeming") may be modified independently of their inner self (their "being"). These children reached the last level of Rochat's self-recognition model. The mask task remains to be administered to older children in order to assess with greater precision the age at which the external self is fully acquired.

5. Conclusion

Our results support the notion that self-awareness is not a monolithic, all-or-none ability but rather consists in at least three different levels. Based on Rochat's model, we implemented three tasks, each corresponding to one of these levels. Our results indicate a decrease in performance across the three tasks. Bearing in mind that this pattern might just reflect the increasing complexity of the three tasks, it could also suggest a developmental scale in self-awareness. Indeed, the mirror task, assessing the first level of the explicit self-awareness, is the task succeeded by most of the children. Then comes picture self-recognition and afterwards, self-recognition wearing a mask that assesses the most sophisticated level of self-awareness, the external self. This task is, to the best of our knowledge, the first attempt to assess awareness of the external self in preverbal children. Performance in this task indicates that such young children show awareness of their external self or, at least, that this ability is in the process of being acquired at 22-month old. Further studies will have to specify the age at which the external self is full acquired.

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