

# Life in Affective Reality: Identification and Classification of Smiling in Early Childhood\*

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**Abstract.** The present study investigated the development of naturally occurring smiles in infancy and early childhood. Twelve to 35-month-old Japanese children ( $N = 22$ ) were videotaped during free play time in nurseries. Participants expressed 417 smiles in over 10.5-hours of recording. A 11 category taxonomy was developed to classify the obtained smiles. The skills of language use were measured using utterance data produced by the target children while they were videotaped. One-year-olds showed more “transferring smiles” than two-year-olds. Whereas more “synchronous smiles” and “unsuccessful smiles” were observed in two-year-olds. “Unsuccessful smiles” were made by children who obtain higher language skills. This study established that the situations of smiles changed from solitary to social by children’s age and language skills. Two-year-olds smile not only in pleasant conditions, but also in unpleasant ones.

**Keywords:** Smiling, Laughter, Infancy, Early Childhood, Play, Interaction.

## 1 Introduction

Wolff [1] is a pioneer in the research of spontaneous smiles that infants show when they sleep. He observed four 5-day-old neonates for an average of 16 hours, and he mentioned that spontaneous smiles were observed “during irregular sleep, drowsiness, and alert inactivity, but never during regular sleep, alert activity, or between bursts of crying [1].” Most data on spontaneous smiles were obtained on neonates, so that some researchers believe that spontaneous smiles disappear at the early stage of development and the smiles are replaced by social smiles and laughs. For example, Kagan and Fox [2] mention that spontaneous smiles disappear at 2-3 months of age. Although there are observational data in six-months-olds [3] and one-year-olds [4], the development of spontaneous smiles and social smiles has not yet been clarified.

Ekman and Friesen [5] proposed four types of adults’ smiles; felt smiles, phony smiles, masking smiles, and miserable smiles. Drahota, Costall, and Reddy [6] classified smiles into Duchenne smiles, non-Duchenne smiles, and suppressed smiles by forms of facial expressions. Duchenne and non-Duchenne smiles are often distinguished using the criterion of the activation of the orbicularis oculi muscles. Drahota et al. [6] defined suppressed smiles that involve counteractions of the lip corner raise and cheek raise during smiles. They mentioned that “smiles can express a large

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\* A part of this study was presented at the 2011 SRCD Biennial Meeting in Montreal, Canada [18].

variety of meanings, ranging from embarrassment to amusement, triumph, bitterness and even anger.” Ekman [7] claims that his technique (i.e., Facial Action Coding System; FACS) can distinguish more than 50 different smiles. There are no adequate observational data, however, that reveals such different kinds of smiles people express. The gap between infants’ social smiles and adults’ smiles also remains.

Phillips and Sellitto [8] mentioned that “definitions of play usually include joy or pleasure as one of several critical components,” but the measurement of emotion used in research on play behavior lacked rigor. This suggests that play situations contain many opportunities to observe smiles, and more accurate observations are required.

Parten’s [9] classification of play is widely applied in research on children’s play. She divided it into six categories; unoccupied behavior, onlooker behavior, solitary play, parallel play, associative play, and cooperative play. Smith [10] classified children’s play into social contingency play, sensorimotor play, object play, language play, physical activity play, and fantasy or pretend play. The category of play activity in this study is based on Parten’s [9], because her categorization focused on social development, and that aspect should relate to the development of smiling.

Language acquisition in children is largely studied in the field of developmental psychology. Researchers have revealed the process of language acquisition. There may be a relation between the skill of language usage, social development and development of smiling, but many handbooks in developmental psychology have not mentioned it (e.g., [11], [12]).

The purpose of this study is to investigate the variation and the function of smiles that are shown by children during free play behavior, and clarify what factors relate to the development of smiles.

## 2 Method

### 2.1 Participants

Eleven one-year-old children (eight female and three male; the range of months in age was from 12 to 23 months) and eleven two-year-old children (six female and five male; the range of months in age was from 24 to 35 months) who were cared for in public nurseries in Tokyo were observed. They were physically and mentally healthy at the time of observation.

### 2.2 Procedure

Participants were observed during the free play period in nurseries. Free play periods are defined as nursery school teachers not forcing children to do something (e.g., singing songs, dancing, or exercising together). In such periods, children can select how to play. Free play periods in nurseries were scheduled from 10:00 to 11:00 in the mornings and from 4:00 to 5:00 in the afternoons almost every day.

The observer videotaped 30 minutes per child by using a digital video camera (HDR-XR500, Sony) and a gun microphone (ECM-HGZ1, Sony). The situation of recording was controlled as follows; (1) there were more than two children in the space of play (i.e., the room or playground in nurseries), (2) children could choose how to play, (3) adults’ control of play was minimized, and (4) the observer kept 50-200 cm from the target child and did not have any direct or indirect contacts with the

child during the recording. The recordings were not always a continuous 30 minutes, because teachers sometimes had to change children's diapers, or the target child went to toilet. If there were some interruptions in the recordings, they were less than 5 minutes.

### 2.3 Coding Scheme of Smiling

Smiles were defined using the FACS AU12 definition [13]. FACS is the most general facial coding system in the field of psychology. AU 12 means "lip corner puller." In the FACS manual, there is a mention that "AU 12 is a significant action that produces appearance changes in the lips and cheeks that most people would call a smile." Recent researches on smiles in children adopt AU 12 as the definition of smiles (e.g., [14], [15]). Another criterion was that the action had to appear subjectively smile-like when viewed at normal speed [16]. This criterion was adopted to exclude too subtle movement of mouth from consideration.

The onset and offset of smiles were determined as follows. The software for controlling recorded video (Picture Motion Browser Ver. 4.2.00 for AVCHD HDD Camcorder, Sony) could move a video sequentially by 1/30 seconds. When a smile was observed, the video was rewound sequentially to the onset frame (immediately prior to which there were no facial movements). From the onset, the video was forwarded sequentially to the offset (immediately following which there were no facial movements).

Smiles were then classified into 11 categories (i.e., solitary smiles, one-sided smiles, synchronous smiles, transferring smiles, approaching smiles, withdrawal smiles, satisfying smiles, unsuccessful smiles, camouflaging smiles, embarrassing smiles, and singing smiles) by using an original coding guide. The guide was constituted from 93 categories of a check list. The coder checked the speech and behavior of the target child and related others (i.e., other children and teachers) by the list. The check list applied only for the situation which smiles were showed by the target child. Almost all activities which occurred at the situations of smiles were confirmed by this list, and those smiles were classified by it.

*Solitary smiles, one-sided smiles and synchronous smiles* were defined by the target child's gaze. *Transferring Smiles, approaching smiles, and withdrawal smiles* were identified by the target child's physical state. *Satisfying smiles, unsuccessful smiles, camouflaging smiles, and embarrassing smiles* were related to the target child's mental state. *Singing smiles* were different from others. Singing reflects not only physical states of children but also mental states. To identify children's smiles for one category, there was the order of priority. The third group and singing smiles were top priority, the second group was the second, and the first group was the third. Each smile was defined as follows.

*Solitary smiles.* If the target child looked at not someone but something when she/he smiled, the smile was coded as a solitary smile. In the case which the subject of the child's gaze was unclear, the smiles were determined as solitary smiles.

*One-sided smiles.* If the target child looked at someone when she/he smiled, but the person did not smile synchronously, the smile was coded as a one-sided smile. In the case which the coder could not see the other person's face, and could not hear the laughing voice, the smiles were counted as one-sided smiles.

*Synchronous smiles.* If the target child looked at someone when she/he smiled, and the person also smiled, the smile was coded as a synchronous smile. In the case which the coder could not see the other person's face, but could hear the laughing voice, the smiles were determined as synchronous smiles.

*Transferring smiles.* If the target child simply walked or crawled around without any particular objects to approach when she/he smiled, the smile was coded as a transferring smile.

*Approaching smiles.* If the target child approached something or someone when she/he smiled, the smile was counted as an approaching smile. It did not matter whether the target child walked or crawled.

*Withdrawal smiles.* If the target child withdrew from something or someone when she/he smiled, the smile was coded as a withdrawal smile. It didn't matter whether the target child walked or crawled.

*Satisfying smiles.* If the target child was praised for her/his achievement and/or completed something when she/he smiled, the smile was coded as a satisfying smiles. The praises and completions were almost always determined by a phrase made by the target or the others, for example "I did it," "you did it," or hand clapping.

*Unsuccessful smiles.* If something which the target child used to play (e.g., blocks or balls) collapsed or fell from somewhere, someone or the target slipped, or the target reported her/his mistakes to someone when she/he smiled, the smile was coded as an unsuccessful smile.

*Camouflaging smiles.* If the child was scolded or made trouble for someone when she/he smiled, the smile was coded as a camouflaging smile.

*Embarrassing smiles.* If someone could not understand the target child's act or utterance, or the target could not understand someone's act or utterance when she/he smiled, the smile was defined as an embarrassing smile.

*Singing smiles.* If the target child sang when she/he smiled, the smile was coded as a singing smile.

## 2.4 Coding Scheme of Play Behavior

Parten's [9] play categories were adapted for classification of play situation. Actual classification had 11 categories, but they were combined to four categories for statistical analyses. Whether there was a smile or not, every situation was coded for one category. Each category of play was defined as follows.

*Non-play behavior.* Moments during which the target child did not have a toy or objects for play, were non-play behavior. In this situation, the child usually watched the other children's play, or just crawled, walked, or ran somewhere not for playing. This category was partly derived from Parten's [9] "unoccupied behavior" and "onlooker."

*Individual play.* Moments during which the target child played alone or independently, were individual play. Even if the child engaged in the same activity which the other child close to her/him did, they did not talk with and not try to influence or modify the activity of the other's. Parten's [9] "solitary play" and "parallel play" were combined to this category.

*Group play.* Moments during which the target child played with other children were group play. Parten's [9] "associative play" and "cooperative play" were combined to this category. In associative play, "there is a borrowing and loaning of play material" [9] and conversations between the target and other children can be observed. Children share the purpose or goal of playing and organize the division of roles in cooperative play.

*Playing with teachers.* Moments which the target child played with a teacher were playing with teachers. Regardless of the target's way of playing, the situation which there was a teacher around the target and she (all teachers in this study was female) related to the play was coded as playing with teachers. Teachers' involvement in play was identified by their speech and behavior to lead children.

## 2.5 Coding Scheme of Language Skill

The skills of language usage were measured by the utterances made by the target children when they were videotaped. The coder made a transcript of all utterances made by the target child and made to the target by others. Every utterance made by the target was labeled. There were seven labels; groan, babbling, one-word sentence, two-word sentence, three-word sentence, four-word sentence, and five-word-or-more sentence. This sequence is arranged in order of developmental stage of language skill. The label which indicated the highest developmental stage of language skill was extracted for each child to identify her/his language skill.

## 3 Results and Discussion

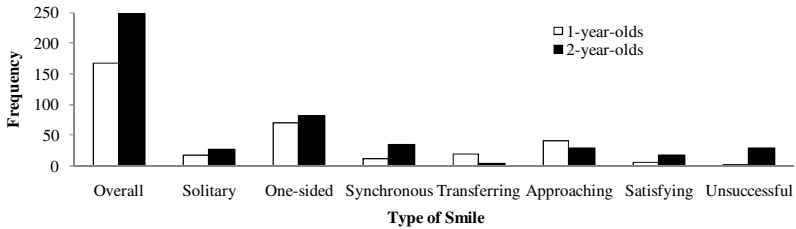
There were 417 smiles in over 10.5-hours of recording. This means that participants showed 18.95 smiles ( $SD = 11.82$ ) in average. One-sided smiles (151 times) and approaching smiles (69 times) occurred frequently in this observation. The frequencies of seven kinds of smiles exceeded 20 times [i.e., solitary smiles (45), one-sided smiles, synchronous smiles (47), transferring smiles (23), approaching smiles, satisfying smiles (23), unsuccessful smiles (32)]. Others were excluded from statistical analyses.

Approximately 25 % of one-sided smiles were directed to the observer in this study. As mentioned above, the observer kept 50-200 cm from the target child and did not have any direct or indirect contacts with the child during the recording. This indicates that all smiles which referred to the observer were coded as one-sided smiles. In some cases, the observer was the nearest person for the target child during the observation. The observer spent one to four weeks at the nurseries before the start of the research. Therefore, many children might not imagine that he could not respond to their smiles. This should be a reason that one-sided smiles were observed frequently.

There were no gender differences in frequencies of smiles. Hay, Caplan, and Nash [17] mentioned that "there is little evidence for striking sex differences in prosocial behavior or conflict with peers before the third birthday." The result of this study supports it.

### 3.1 Relation between Smiles and Age

There were different patterns in frequencies of smiles by children’s age. Figure 1 shows frequencies of each type of smile by age. Two-year-old children showed significantly more smiles than one-year-olds overall,  $\chi^2 (1) = 7.87, p < 0.01$ . The participant who showed the most frequent smile was a 32-month-old girl. She smiled 54 times in a 30-minute observation. She was a factor of this result, but other factors must be found in developmental differences between one and two-year-olds.



**Fig. 1.** Frequencies of each type of smile by age

Table 1 indicates the actual frequencies of each type of smile by age. One-year-olds showed significantly more transferring smiles than two-year-olds,  $\chi^2 (1) = 4.89, p < 0.05$ . In these smiles, children looked simply transferring to somewhere without any targets. This kind of walk and crawl can be seen mostly in infants. Walking and crawling is not a commonplace event, but a special event for them. Probably, parents and teachers in nurseries praise them at the beginning of such activities. This mechanism would bring a feeling of satisfaction to children, and they expressed smiles.

Two-year-olds showed significantly more synchronous smiles than one-year-olds,  $\chi^2 (1) = 6.65, p < 0.01$ . In the situations of synchronous smiles, children showed smiles before or after the other person showed them. They shared the attentions to an object and the feelings. The feelings can be not only joy but also embarrassment. It is difficult to presume their feelings from facial expressions. This is a limitation of this study. It is certain, however, that older children have more ability to share their feelings by using smiles.

**Table 1.** Frequencies of each type of smile by age

Type of Smiles	Frequencies	
	Age	
	1-year-olds	2-year-olds
Solitary	17	28
One-sided	70	81
Synchronous	11	36
Transferring	19	4
Approaching	40	29
Satisfying	5	18
Unsuccessful	2	30

Two-year-olds also made more unsuccessful smiles than one-year-olds significantly,  $\chi^2(1) = 12.25, p < 0.001$ . These smiles occurred when the target children or other children nearby made some mistakes, and saw them. This suggests that older children show smiles not only in pleasurable situations but also in unpleasant situations.

Sometimes this category of smiles occurred in series. In that case, children looked joyfully and made the unsuccessful situations intentionally. For example, the 32-month-old girl collapsed the tower which she made with blocks. It happened accidentally at first, but she made and collapsed it over and over, and then she smiled. She played the repetition, and it looked as if she made the tower for collapsing.

### 3.2 Relation between Smiles and Play

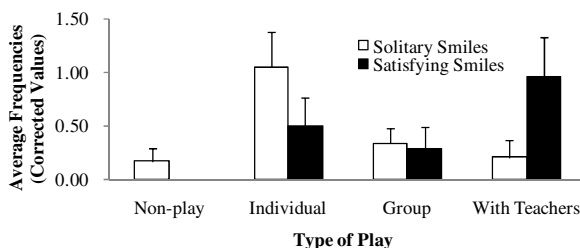
There was a difference in total amounts of time for each type of play. Table 2 shows the difference and ratios. Approximately half of play was individual play, and one fifth was play with teachers. This tendency had something in common with the results of Parten [9]. Her participants who were two to two and a half years old devoted much time to solitary play and parallel play (i.e., individual play in this study).

To compare the frequencies of smiles by type of play, the data corrections were made for frequencies of each child's smiles by multiplying one minus the ratios of each playing time. An ANOVA indicated a significant frequency differences in solitary smiles for each type of play,  $F(3, 42) = 4.15, p < 0.05$ . Figure 2 indicated that there were more solitary smiles in individual play. This tendency was rational that children must keep their gaze at something in solitary smiles, and there were less people around them in individual play. The multiple comparison of the Bonferroni method showed, however, that there was no significant difference in each type of play. This tendency must be confirmed by collecting more data.

**Table 2.** Total amounts of time and ratios for each type of play

Type of Play	Total Amounts of time (min.)	Ratios
Non-play	85	0.13
Individual	324	0.51
Group	93	0.15
With Teachers	135	0.21

An ANOVA also indicated a significant frequency differences in satisfying smiles for each type of play,  $F(3, 24) = 3.48, p < 0.05$ . The multiple comparison of the Bonferroni method showed that there was no significant difference in each type of play. There was a tendency, however, that children showed more satisfying smiles in playing with teachers (see Figure 2). Teachers tend to praise children when they achieve or complete something. In fact, teachers praised the target child nine times out of 11 satisfying smiles during playing with teachers. This suggested that teacher's reactions for children increased their playing activities for achievement and their smiling. Teachers in nurseries must have an important role in the development of emotions.



**Fig. 2.** Average frequencies (corrected values) and SEs of solitary and satisfying smiles in each type of play

### 3.3 Relation between Smiles and Language Skills

The stage of language development for each child was decided from their utterances. Table 3 shows the numbers of participants for each stage. The numbers varied widely, so the stages were combined into two groups for statistical analyses. Children in the stages from babbling to two-word sentence were integrated into elementary language development group ( $N = 10$ ) in this study. Children in the stages from three-word sentence and above were also gathered in advanced language development group ( $N = 12$ ) in this study. The difference in numbers of participants for each group still remained, so the data corrections were made for total frequencies of each type of smiles by multiplying one minus ratios of each number of participants in the group.

A significant difference was found in frequencies of unsuccessful smiles,  $\chi^2(1) = 5.34$ ,  $p < 0.05$ . Table 4 indicates that the advanced language development group showed more unsuccessful smiles frequently. This means that higher skill of language usage is necessary for unsuccessful smiles. In some cases of unsuccessful smiles, teachers told the target child that for example, "Ooh! It's collapsed," when they saw it happen. In this case, language skills have some functions for understanding of the failure and for sharing the same emotion with others.

**Table 3.** Numbers of participants for each stage of language development

Stages of Language Development	N
Babbling	2
One-word Sentence	5
Two-word Sentence	3
Three-word Sentence	4
Four-word Sentence	1
Five-word-or-more Sentence	7

**Table 4.** Frequencies and corrected frequencies of unsuccessful smiles for each stage of language development

Stages of Language Development	Frequencies	Corrected Value
Elementary	2	1.09
Advanced	30	13.64



## 4 Conclusion

This study establishes a new style of classification in children's smiles. Detailed descriptions of situation and classifications of smiles from them are the core of this study. Four hundred seventeen smiles were obtained from one to two-year-old children, and they were divided into 11 different kinds of smiles.

Younger children showed more smiles when they simply crawled or walked without particular targets. Older children smiled synchronously with others and they smiled even if they were faced with failure situations. The playing situation had also important role for smiles. Children frequently smiled at something and not someone when they played individually, whereas they made satisfying smiles when they achieved or completed something with teachers. Children who had advanced language skills showed more smiles when they were faced with failure situations.

These observational data suggest that smiles develop from individual to social and from simple signs of pleasure to indications of more complex emotions. Judgment of children's social and emotional development can be made by their variations of smiles. It is more important, however, to provide joyful environment for children to see their smiles. Smiles are undoubtedly condensed cognitive-affective responses to the complex realities of life.

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