



Can we observe spontaneous smiles in 1-year-olds?

Fumito Kawakami^a, Kiyobumi Kawakami^{b,*},
Masaki Tomonaga^c, Kiyoko Takai-Kawakami^d

^a Tokyo Institute of Technology, 2-12-1, Ookayama, Meguro-ku, Tokyo 152-8550, Japan

^b Department of Psychology, University of the Sacred Heart, 4-3-1, Hiroo, Shibuya-ku, Tokyo 150-8938, Japan

^c Primate Research Institute, Kyoto University, Kanrin, Inuyama, Aichi 484-8506, Japan

^d Japan Women's University, 2-8-1, Mejirodai, Bunkyo-ku, Tokyo 112-8681, Japan

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ABSTRACT

Five infants were observed longitudinally. In over 30 h of observations, seven spontaneous smiles and one spontaneous laugh were found. All smiles were observed in infants between the ages of 10 and 15 months. These data indicate that spontaneous smiles do not disappear at 2 months of age and they still exist at over 15 months. This disproves some emotional expression theories, where spontaneous smiles are considered to be precursor to and replaced by social smiles. Our data suggest that those theories must be revised and provide new perspectives on this field of studies.

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1. Introduction

One of the leading researchers on the development of smiling, Dondi (2008) notes that “Based on the studies performed during the Sixties by Peter Wolff, neonatal smiling has been generally defined as the bilateral sideward and upward drawing of the corners of the mouth into a partial U-shaped configuration, that is achieved by contraction of the *zygomaticus major* muscles (p. 10).” He writes “neonatal smiling is generally considered to be a behaviour which occurs in the absence of recognized external or internal stimuli. For this reason, it is known in literature as *reflexive*, *spontaneous* or *endogenous* smiling (pp. 9–10).” And he claims “Unlike the *social smiling* that has been analyzed in several empirical contributions, very little is known about the significance, form, and recognizability of neonatal smiles or their developmental relevance for later smiling (p. 9).”

As Dondi (2008) states, Wolff (1959, 1963, 1987) is a pioneer in the research of spontaneous smiles. Freedman (1965, 1974), Gewirtz (1965) and Emde, McCartney and Harman (1971) also studied spontaneous smiling. Ambrose (1961, 1963) was another who studied the development of smiling in infancy. And recently, Messinger et al. (2002) and Dondi et al. (2007) studied spontaneous smiles using new techniques.

Kawakami et al. (2008) observed preterm neonates in a search for the roots of smiles. The youngest neonates, 200 days from conception, showed spontaneous smiles. Kawakami et al. (2006) found “spontaneous laughs (smiles accompanied by vocal sounds)” in newborns.

* Corresponding author.

E-mail address: kawakami@u-sacred-heart.ac.jp (K. Kawakami).

Table 1
Infant age in days at the observations.

	I	Y	R	S	H
1	361	359 ^a	337	231	172
2	459 ^a	373 ^a	360	254	200
3	494	401	428	318 ^a	284
4	536	453	435	329	312 ^a
5	550	485	463	399	347
6	585	513	547		382
7		576			

^a The day which spontaneous smiles or the laugh were observed.

Textbooks and handbooks on developmental psychology claim that spontaneous smiles disappear at 2–3 months of age (e.g., Kagan & Fox, 2006). However, spontaneous smiles can be observed as late as 6 months of age (Kawakami et al., 2007).

The purpose of this study was to present the data of spontaneous smiles and spontaneous laugh after age 6 months. The data of this study will demonstrate that these behaviors are not neonatal reflexes. Based on these results revisions will be required in many textbooks and handbooks on developmental psychology. From these data, new perspectives on the developmental processes of smiles and laughs should be discussed.

2. Method

2.1. Participants

Five (three females and two males) infants around their first birthday (see Table 1) were observed longitudinally. Table 1 shows the age in days when they were observed for 1 h per observation. All infants were observed at least five times with an average six observation times. They were cared for in a private nursery in Tokyo. The observational design was explained to parents, and informed consent was obtained. This research was conducted with the fully informed permission of the Research Ethics Committee of University of the Sacred Heart.

2.2. Procedure

By the daily time schedule of the nursery, infants eat lunch before noon, and have a nap after that. The observer recorded the infant's face by Digital Camera Recorder (SONY DCR-PC110) en face during a nap. The infants were observed for 1 h per observation (shortest 1 h:00 min:01 s–longest 1 h:02 min:40 s).

2.3. Definition of “spontaneous smile” and “spontaneous laugh”

To code infant's smile, Oster (1978) used three criteria: (1) the action had to appear subjectively smile-like when viewed at normal speed; (2) there had to be more than a trace of AU12 [Action Unit in the Facial Action Coding System (FACS), Ekman & Friesen, 1978]; and (3) the AU12 component of the smile had to be visible for at least 1 s. AU12 (lip corner raising) is recognized as the basis of all smiles by other researchers (e.g., Messinger et al., 2002). “Lip corner raising” is also an important criterion in other facial coding systems [e.g., Code 52 in The Maximally Discriminative Facial Movement Coding System (MAX), Izard, 1983].

Strict criteria was adopted for identifying spontaneous smiles and spontaneous laughs as follows: (1) lip corner raising; (2) during irregular sleep, drowsiness; (3) without known external or systematically demonstrable internal causes (Wolff, 1963); (4) continuing more than 1 s; (5) smiles continued within 1/6 s were combined; and (6) smiles with vocal sounds are defined as spontaneous laughs.

The onset and offset of smiles and laughs were determined as follows. The digital video camera recorder had a button to move a video sequentially by 1/30 s. 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).

2.4. Coding

Two coders independently identified spontaneous smiles and laugh using the Digital Camera Recorder (Sony DCR-PC110). Only spontaneous smiles and spontaneous laugh identified by both coders were included in the subsequent analysis. The percentage of intercoder agreement was 93.3%. Correlation of the event durations recorded by the two coders was $r = 0.98$ ($p < 0.01$).

Table 2
Raw data.

	Infant age in days	Duration (s)	Lateral
Spontaneous smile	459	3.19	Bilateral
	373	1.55	Bilateral
	359	5.74	Bilateral
	318	3.29	Bilateral
	318	5.04	Bilateral
	318	1.44	Bilateral
	318	2.19	Bilateral
Spontaneous laugh	312	1.94	Bilateral

3. Results

3.1. The basic data

In Table 1, the “small a” refers to the infant age in days when spontaneous smiles or spontaneous laugh were recorded. One of the five infants had never shown spontaneous smiles and laughs. Table 2 shows the raw data of spontaneous smiles and a spontaneous laugh. Only seven spontaneous smiles and one spontaneous laugh were recorded in 30 h. The mean duration of spontaneous smiles was 3.20 s (S.D. = 1.67), and the duration of one spontaneous laugh was 1.94 s. Fig. 1 shows a spontaneous smile in the 459-day-old.

Kawakami et al. (2006) observed newborns using almost the same procedures of this study, and Kawakami et al. (2008) observed preterm neonates exhibited spontaneous smiles. Twenty-four spontaneous smiles were observed in 10 h on newborns, and 95 spontaneous smiles were recorded in 22 h on preterm neonates. Spontaneous smiles decrease gradually but it is important to note that there were some spontaneous smiles in 1-year-olds.

The mean duration of spontaneous smiles in newborn infants was 1.97 s (S.D. = 0.68, Kawakami et al., 2006), and in preterm neonates was 3.28 s (S.D. = 1.56, Kawakami et al., 2008). So the data of this study is similar to those of preterm neonates not to those of newborns.

All spontaneous smiles and one spontaneous laugh were bilateral (see Table 2). This result might be inevitable, because the percentages of bilateral spontaneous smiles increase in the second or third months of life and almost all spontaneous laughs were bilateral (Kawakami et al., 2006, 2007).

3.2. Semi-burst of smiles

Kawakami et al. (2007) defined the bursts of spontaneous smiles as a “period of more than seven spontaneous smiles in seven minutes.” One infant showed four spontaneous smiles in 1 min. This did not meet the definition of the bursts, so it is classified as a semi-burst of smiles.

3.3. Spontaneous laugh

Only one spontaneous laugh was observed. Fig. 2 shows the sound waves of it. As noted earlier, this spontaneous laugh was bilateral.



Fig. 1. Spontaneous smile at the 459 days of infant age (ID: I).

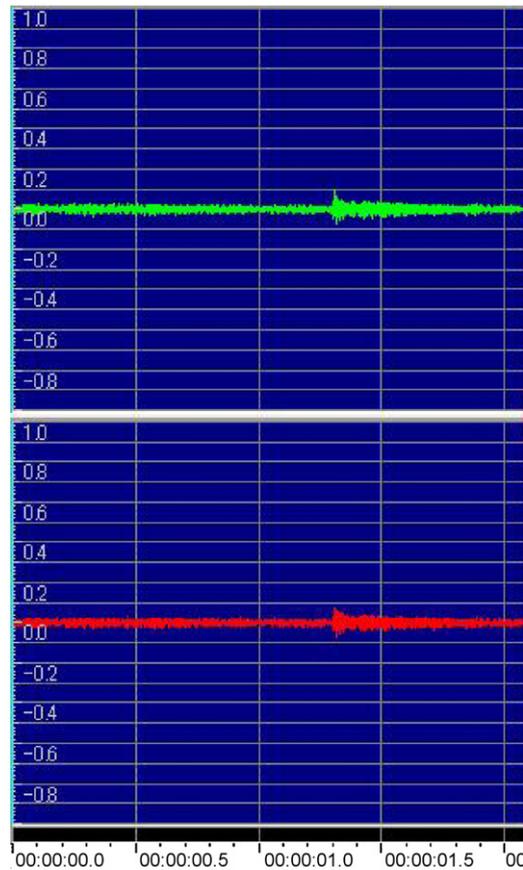


Fig. 2. The sound waves of spontaneous laugh (GoldWave v5.06).

4. Discussion

The main finding of this study was that spontaneous smiles were recorded in two 1-year-olds. The title of this article is “Can we observe spontaneous smiles in 1-year-olds?” The answer is “Yes.” This article provides the first evidence that infants show spontaneous smiles after the sixth month of life, and they continue to smile spontaneously around the 15 months.

Fig. 3a shows the typical explanation on the development of smile and laugh in textbooks and handbooks of developmental psychology (e.g., Sroufe & Waters, 1976). Many researchers believe that spontaneous smiles are replaced by social smiles at around 2 months of age, and social laughs emerge from age 4 months. There are no clear definitions of smiles and laughs, so the difference between them is ambiguous. Importantly, past works missed spontaneous laughs. Fig. 3b shows the data on spontaneous smiles and spontaneous laughs from our studies (Kawakami et al., 2006, 2007) and this study. Spontaneous smiles begin from the birth, and continue for at least 15 months of age. Infants show spontaneous laughs from their birth to at least age 10 months. These findings somewhat contradict common views on development of spontaneous smiles, laughs, and facial expressions on two points.

Theories of emotion explain that spontaneous smiles are the origin of social smiles which infants show from the second month of their lives, so they decrease or disappear around that period. The authors of this study believe that spontaneous smiles have some functions in developing infants’ facial expressions. For example, spontaneous smiles may serve to strengthen the *zygomaticus major* muscles. There is, however, no data on the functions of spontaneous smiles take. It would appear overly simplistic to determine that spontaneous smiles change into social smiles. Data from this study disagree with the theory that spontaneous smiles disappear at 2 months and social smiles emerge at that period. Fig. 3a and b indicates that spontaneous smiles are not replaced with social smiles, but that spontaneous smiles and social smiles exist in the same period of life, and this continues for at least 13 months. Facts of this study entirely change the common view of the relation between spontaneous smiles and social smiles.

Secondly, in Fig. 3a, the part of spontaneous laugh is blank, because there is no data and reference to them. This research defines spontaneous laughs is spontaneous smiles with vocal sounds. Prior to Kawakami et al. (2006), numerous research projects had been carried on the development of emotion, all of which overlooked that element of smiles. Prior research only focused their attention on the development of social laughs. That past works have described “laughter appears at about four months” may originate from the review by Sroufe and Waters (1976). Kawakami et al. (2006)

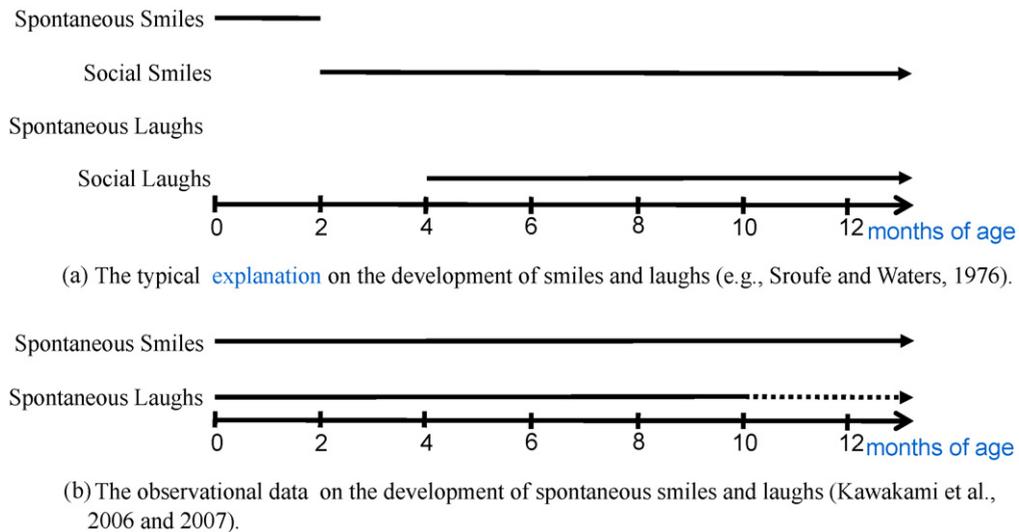


Fig. 3. (a) The typical explanation on the development of smiles and laughs (e.g., Sroufe & Waters, 1976). (b) The observational data on the development of spontaneous smiles and laughs (Kawakami et al., 2006, 2007).

showed that from birth human newborns laugh while asleep. This article demonstrates that phenomenon continues for at least 10 months. Like the relation between spontaneous smiles and social smiles, the link between spontaneous laughs and social laughs is also ambiguous. It will be important to discover these links and to determine the function of spontaneous laughs.

There were no unilateral spontaneous smiles and laughs in this observation (see Table 2). Kawakami et al. (2006, 2007) found that unilateral spontaneous smiles were more frequent than bilateral smiles in full-term neonates, but by the second month bilateral smiles were more frequent. The results of this study are consistent with those findings, and the tendency to increase the rate of bilateral smiles becomes robust. This tendency differs from the results of Holowka and Petitto (2002) who showed that infants from 5 to 12 months open the right side of their mouth while babbling and open the left side while smiling. This suggests that babies in 5–12 months of age already have the laterality of brain, that the right hemisphere controls emotional expression and the left controls linguistic skills. If the laterality exists in the brain of infants at such an age, the number of unilateral or left-sided spontaneous smiles could increase. But the results of the current study do not match with this. This is incongruent with theories of localization in brain activity in which many functions are lateralized into one hemisphere. It will be necessary to continue watching spontaneous smiles longitudinally and make clear the connection between spontaneous smiles and brain development.

A semi-burst of smiles found in this study was very intensive. There were four spontaneous smiles in 1 min. It is difficult to clarify what mechanisms cause this bursts of smiles. It may be a limitation of behavioral observation. Future investigation into brain activity is required to understand the mechanisms of smiling and laughter at the smile bursts. Questions about the kind of activity in the brain during smiling and laughing need to be answered.

During 30 observations, recorded over approximately 30 h, there were only seven spontaneous smiles and one spontaneous laugh. While the conditions of recordings were not well controlled between this study and former work (e.g., Kawakami et al., 2006, 2007, 2008), it is difficult to determine that spontaneous smiles do not decrease after 6 months. It is not a certain data, but the first author of this article observed 2–6-year-olds' napping in a nursery 30 times, and observed no spontaneous smiles. In our experience of observation, we have almost never seen spontaneous smiles apart from irregular sleep or drowsiness [i.e., rapid eye movement (REM) sleep]. The percentage of REM sleep in children decreases with every month and every year (Kohyama, Shimohira, & Iwakawa, 1997). The decline of REM periods in children's sleep is likely to be a factor of the gradual decrease of spontaneous smiles. Therefore, spontaneous smiles should gradually decrease after around the sixth month of life and almost completely disappear by 2 years of age.

Spontaneous laugh was observed in a 312-day-old infant. The baby looked so happy at that time. She could have had a nice dream. But actually, it is hard to know her feelings and at what age infants begin to dream. It is not possible to answer this mystery now.

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