

# Nakama: A Companion for Non-verbal Affective Communication

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## ABSTRACT

We present “Nakama”: A communication device that supports affective communication between a child and its - geographically separated - parent. Nakama consists of a control unit at the parent’s end and an actuated teddy bear for the child. The bear contains several communication channels, including social touch, temperature, and vibrotactile heartbeats; all aimed at increasing the sense of presence. The current version of Nakama is suitable for user evaluations in lab settings, with which we aim to gain a more thorough understanding of the opportunities and limitations of these less traditional communication channels.

## Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation e.g., HCI]: User Interfaces—*Haptic I/O, Prototyping*

## Keywords

Affective Communication; Mediated Touch; Temperature; Haptics

## 1. INTRODUCTION

There are several circumstances in which a child is geographically separated from one or both of its parents; for instance due to a divorce, hospitalization, or work-related situations. Because of the absence of the parent, such circumstances may be stressful for the child. In order to provide social support and to create a sense of being together, the absent parent usually utilizes telephone or text messages. These traditional communication media however do not always suffice. That is, they may be too cognitively demanding and/or it may be difficult for the parent to keep the child

engaged in the conversation [7]. Moreover, it can be difficult to convey affective feelings by means of only verbal communication. Video conferencing allows one to convey facial expressions in order to emphasize the emotions associated with the spoken words. However, current technologies do oftentimes not facilitate other means of non-verbal affective communication.

The aim of the project was to develop a medium that facilitates affective interaction between child and parent, by utilizing communication channels that address multiple sensory modalities. Moreover, the device should be approachable and engaging for the child. We particularly set out to incorporate several haptic communication channels in the device. This is because these are underrepresented in current communication technologies, despite their potential for affective communication [5].

## 2. NAKAMA

Based on findings from literature as well as from interviews with children, (grand)parents, and researchers in the field of Human-Computer Interaction, we developed “Nakama”. Nakama - a Japanese word for “Companion”; derived from the Japanese words “naka” (“relationship”) and “ma” (“space” or “room”) - consists of two main components: a control unit which is held by the parent and an output device at the child’s side (see Figure 1). The output device has the appearance of an ordinary teddy bear, in order to fit the child’s



Figure 1: “Nakama”: the bear and control unit.

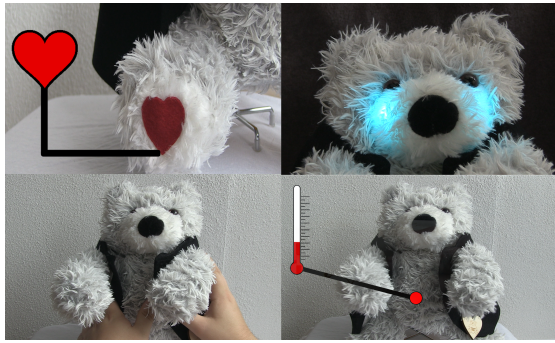
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**Figure 2: Nakama’s communication channels. Clockwise, starting top left: Vibrotactile heartbeat, colors, temperature, and touching and gesturing.**

daily surroundings. The output part of Nakama consists of several communication channels that can be controlled by the parent (see Figure 2). Although Nakama can be used as a stand-alone system, the idea is that it is used in conjunction with a videochat function<sup>1</sup>.

## 2.1 Social Touch

In co-located interpersonal interactions, social touches such as a friendly pat on the back or a comforting hug play an important role. Depending on the context and the actual touching action, a touch can have several consequences on a physiological, cognitive, and behavioral level [1]. Moreover, touch is the most important non-verbal communication channel for the conveyance of intimate emotions. Recent research suggests that social responses similar to real-life responses can be achieved when the touch is simulated by haptic technology. This applies for touches that are mediated, but may also apply for touches that are initiated by an embodied agent [5]. The importance of affectively touching is also demonstrated by research on so-called robotic companions. “Paro” - a robotic seal that responds to caresses - is for instance applied in elderly care settings, and has proven to decrease feelings of loneliness and physiological stress responses (e.g. [4]). Nakama allows for social touching: The bear is equipped with servo motors in the arms that can be controlled by joysticks on the control unit. When the child is within the arm’s reach, the parent can affectively touch the child via Nakama. Moreover, the parent can control the responses of the bear, when the child is touching it.

## 2.2 Temperature

Another related haptic communication channel consists of a heat pad integrated in the belly of Nakama. When a parent is present and holding the control unit, this presence is detected with a temperature sensor and subsequently conveyed by a temperature increase. The choice for temperature as means of affective communication is based on a recently discovered link between exposure to physical warmth (and coldness) and emotional and behavioral responses associated with temperature. More concrete: When people feel warmth in an object or when the ambient temperature is relatively high, they perceive others as metaphorically warmer people [6], and they feel socially closer to others [2].

<sup>1</sup>See <https://youtu.be/3oIu5AyNtEo> for a video of Nakama.

## 2.3 Heartbeats

The third haptic communication channel that is integrated in Nakama is aimed at conveying the parent’s heartbeat. A heartrate sensor connected to the control unit is worn by the parent, and the measured heartbeat is displayed to the child by means of a vibrotactile motor in one of the feet of Nakama. Earlier research on heartbeats that are used as an affective communication channel has demonstrated that people, when they hear a heartbeat, attribute emotional meaning to it. Moreover, people perceive hearing another person’s heartbeat as being very intimate (e.g., [3]).

## 2.4 Additional Communication Channels

Besides the haptic communication channels, Nakama utilizes several other means of non-verbal communication. The servo motors in the arms, as well as additional servo motors in the ears of the bear, allow for gesturing (e.g., waving) and wiggling with the ears. Moreover, RGB LEDs are integrated in the cheeks of the bear. Both the color changes and the gestures may be used to play with, to express different moods, or to emphasize other messages. Moreover, a speaker is integrated in the body of Nakama that can play music and pre-recorded messages. All the additional communication channels are controlled via a keypad in the control unit.

## 3. DISCUSSION

We have developed Nakama, a device that facilitates the conveyance of multimodal messages aimed at supporting affective and engaging child-parent communication. The current version of Nakama is not yet equipped with wireless communication capabilities and can therefore not be applied in practice. The prototype is being used in user studies in the lab; preliminary results indicate that both warmth and heartbeats (when attributed to the parent) can increase the child’s sense of being together. We envision several studies aimed at investigating how the child interacts with the bear and the system as a whole, as well as at evaluating the potential social consequences of the communication channels.

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