

# Does empathic Robot Behavior enhance positive Emotions in Child-Robot Interaction?

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**Abstract.** Empathic behavior of robots can improve the emotional quality of human-robot interaction. To test if this is also valid for children, pupils played chess in an experimental setting at school with a robot that uses empathic strategies. The observed emotional expressions of the children were categorized based on the model of Plutchik. MANOVA analysis showed no significant difference regarding positive emotions between three conditions of robot empathic behavior. Design guidelines to improve the last were deduced.

**Keywords:** Child-Robot Interaction, Empathy, Emotion

## 1 Introduction

For the integration of robots in our daily life we need research how to develop them more capable of interacting with humans. Empathy helps forming social relationships between humans. First research in Human-Robot Interaction gives hint that empathic behavior facilitates also the interaction between adults and robots [1]. The aim of this study is to discover if empathic behavior of robots can enhance positive emotions in the interaction between children and robots.

## 2 Methods

24 children (11 male, 8 to 10 years) played chess with an empathic iCat robot<sup>1</sup> in a Portuguese elementary school. Three experimental conditions were conducted to test the effect of iCat's empathic capabilities (not empathic, randomly empathic, child adapted empathic) [2]. We analyzed the videos of the experimental sessions and categorized the occurring emotions based on Plutchik's evolutionary model [3] of emotions. He defined 8 basic emotions by three dimensions: valence, intensity, and activity. For the research question we focused on the valence dimension and counted

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<sup>1</sup> iCat is a product of Philips; programming by Portuguese project members (see [2])

the relative frequency for negative and positive emotional expressions. Finally, data were statistically analyzed by MANOVA to test the following hypothesis: The higher the grade of empathic behavior, the higher is the occurrence of positive emotions, and the lower the occurrence of negative emotions. As exploratory question we wanted to know if the sex of the children had influence on their emotions.

### **3 Results**

Over all subjects and conditions the occurrence of positive ( $M = 23.38 \%$ ) emotions was lower than that of negative ( $M = 76.62 \%$ ). Hypotheses were not confirmed. MANOVA analysis did not show a significant effect of the factor 'condition' ( $F = .475$ ;  $p = .629$ ) on the dependent variables. Neither the factor 'sex' ( $F = .184$ ;  $p = .673$ ), nor the interaction term ( $F = .245$ ;  $p = .785$ ) were significant. But there is a trend of data that the occurrence of positive emotions increases with higher empathy.

### **4 Discussion**

Despite of the empathic robot strategies, the children had more negative than positive emotions playing with iCat. Design guidelines to improve empathic robot behavior were deduced, e.g. more talking to reduce children's stress, and the moderation of negative feedback to reduce frustration.

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