# Spontaneous Reorientation for Self-Localization

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**Abstract.** Humanoid robots without internal sensors (e.g. compasses) tend to lose their orientation after a fall or collision. Furthermore, artificial environments are typically rotationally symmetric, causing ambiguities in self-localization. The approach proposed here does not alter the measurement step in the robot's self-localization. Instead it delivers confidence values for rotationally symmetric poses to the robot's behaviour controller, which then commands the robot's self-localization. The behaviour controller uses these confidence values and triggers commands to rearrange the self-localization's pose beliefs within one measurement cycle. This helps the self-localization algorithm to converge to the correct pose and prevents the algorithm from getting stuck in local minima. Experiments in a symmetric environment with a simulated and a real humanoid NAO robot show that this significantly improves the system.

## 1 Introduction

Mobile robots have to localise themselves in order to navigate reliably and efficiently. Because of this, robot systems are designed to handle multi-modal distribution in self-localization scenarios [1], [2]. However, this leads to ambiguities in rotationally symmetric environments. Estimating the correct viewing direction solves these pose ambiguities in various ways. The estimated viewing direction can be integrated into the self-localization filter [3] or it can augment the Behaviour Controller (BC) with additional knowledge in order to trigger a reorientation behaviour.

Recent experiments conducted by psychologists on humans and animals in symmetric environments [4–6] have proven the existence of a spontaneous reorientation mechanism and the importance of geometric knowledge. In the mid 90s, Hermer and Spelke [5] showed that geometric knowledge is more important than non-geometric information in orientation. After the having been disoriented, young children (at a mean age of 20.9 months) had to find a toy which had been hidden under their observation in a corner. The room was rectangular with two wall lengths, and even when one wall was painted differently, children looked in the geometrically appropriate corners equally often and ignored the non-geometric information. Recently, Lee et al. [6] showed that the geometric impression of a room can be altered by using printed 2D shapes (dots of two sizes)