Accepted Manuscript

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PII: S0921-8890(16)30667-4
DOI: http://dx.doi.org/10.1016/j.robot.2016.10.013
Reference: ROBOT 2730

To appear in: *Robotics and Autonomous Systems*

Received date : 6 July 2015
Revised date : 7 September 2016
Accepted date : 17 October 2016

Please cite this article as: D. St-Onge, et al., Control, localization and human interaction with an autonomous lighter-than-air performer, *Robotics and Autonomous Systems* (2016), http://dx.doi.org/10.1016/j.robot.2016.10.013

Control, localization and human interaction with an autonomous lighter-than-air performer.

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Abstract

Due to the recent technological progress, Human-Robot Interaction (HRI) has become a major field of research in both engineering and artistic realms, particularly so in the last decade. The mainstream interests are, however, extremely diverse: challenges are continuously shifting, the evolution of robot skills, as well as the advances in methods for understanding their environment radically impact the design and implementation of research prototypes. When directly deployed in a public installation or artistic performances, robots help foster the next level of understanding in HRI. To this effect, this paper presents a successful interdisciplinary art-science-technology project, the *Aerostabiles*, leading to a new way of conducting HRI research. The project consists of developing a mechatronic, intelligent platform embodied in multiple geometric blimps—cubes—that hover and move in the air. The artistic context of this project required a number of advances in engineering on the aspects of localization and control systems, flight dynamics, as well as interaction strategies, and their evolution through periods of collective activities called "research-creation residencies". These events involve artists, engineers, and performers working in close collaboration, sometimes, over several weeks at a time. They generate fruitful exchanges between all researchers, but most of all, they present a unique and creative way to direct and focus the robotics development. This paper represents an overview of the technical contributions from a range of expertise through the artistic drive of the *Aerostabiles* project.

Keywords: robotic blimp, robotic art, human-robot interaction, dynamic modelling, mobile robotics, airship, theater

1. Introduction

The realm of robotics has always required a wide variety of expertise to ensure that the results fully correspond to the objectives and intentions of the designers. Unfortunately, the robotic development most frequently occurs in specialized robotics research facilities and involves homogeneous groups of highly skilled technical experts and engineers. Although multidisciplinary teams slowly started to appear in universities in the last decade, involving engineers from different disciplines as well as psychologists, such groups are often missing the people that are seen as the experts in the fields of creativity, perception, and sense-crafting—the ubiquitous artist.

Simultaneously, several major robotic artworks were created by visionary artists such as White, Roussi, Shanon, Vorn, and Moura [1]. Norman White's "Facing Out Laying Low"[1] was among the first interactive microcontroller based artistic installations embedded with a basic "intelligence". It reacted to the surrounding light and sounds and expressed its enthusiasm by whistling. This art installation came a decade after Shanon's reactive "Squat robot"[2], which was triggered by visitors when touching a plant [2], and a decade before

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[1]White, N. *Facing Out Laying Low*. 1977. plexiglass, motors, electronics. Collection Norman White. Ottawa.

[2]Shanon, T. *Squat robot*. 1966. Live plant, electronic sensors, painted metal, motor, rollers. John Kingsley Shanon Collection. Caledonia.