

# HRI Reading Group

@ Instituto Superior Técnico  
Spring 2019

Meeting #11 (May 24, 2019)

# Paper

Santos, M., & Egerstedt, M. (2019). **From Motions to Emotions: Can the Fundamental Emotions be Expressed in a Robot Swarm?** *arXiv preprint arXiv:1903.12118*.

# Paper

A yellow speech bubble with a tail pointing towards the text below it.

What is  
arXiv?

Santos, M., & Egerstedt, M. (2019). [From Motions to Emotions: Can the Fundamental Emotions be Expressed in a Robot Swarm?](#) *arXiv preprint arXiv:1903.12118*.

Pre-printing service

# What are robot swarms? And what is their potential?

Do not have individual personalities, but collective behaviors.

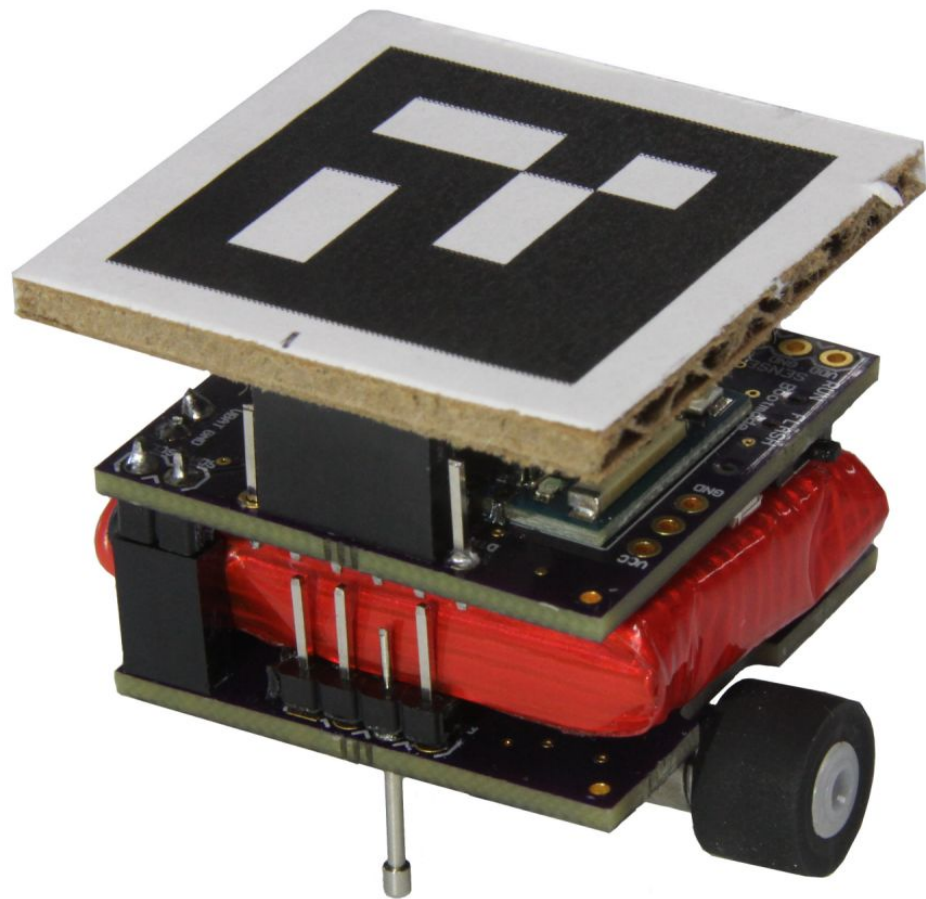
Movement (locomotion) are important and the swarms communicate between them. They are therefore part of a group plan.

Common goal, local communication.

Individual entities become a swarm when they get together in the same place with a common goal.

Education. Search and rescue. Artistic purpose.

# Paper vision



# Emotion models

TABLE I

MOVEMENT AND SHAPE ATTRIBUTES ASSOCIATED WITH DIFFERENT FUNDAMENTAL EMOTIONS.

Emotion	Shape Features	Movement Features	Size
Happiness	roundness, curvilinearity [28]	smoothness [29]	big [30]
Surprise	roundness [28]		very big [30]
Sadness	roundness [28]	small, slow [31], [32]	small [30]
Anger		large, fast, angular [31]	
Fear	downward pointing triangles [33]	small, slow [31], [32]	

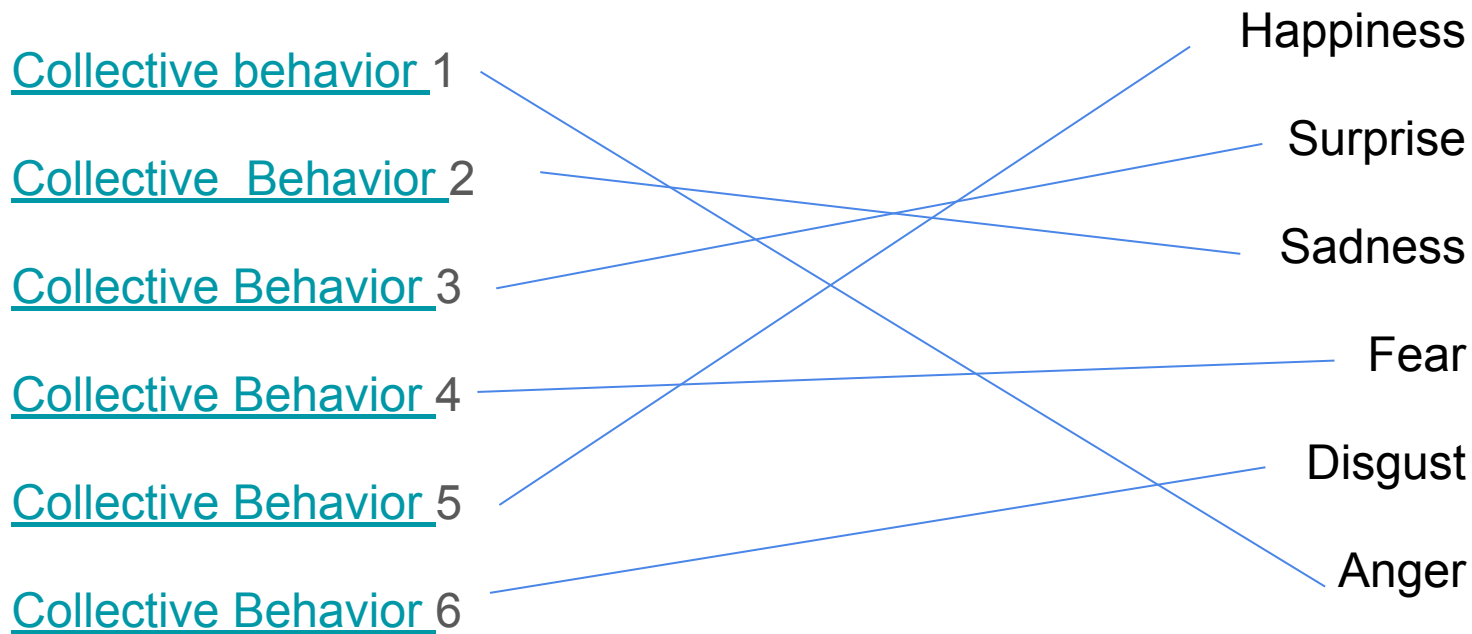
# Emotion models

TABLE II

MOVEMENT AND SHAPE ATTRIBUTES ASSOCIATED WITH THE VALENCE  
OF AN EMOTION [28], [33].

Valence	Shape Features	Movement Features
Positive	roundness	rounded movement trace
Negative	angularity	angular movement trace

# Can you guess the emotion?



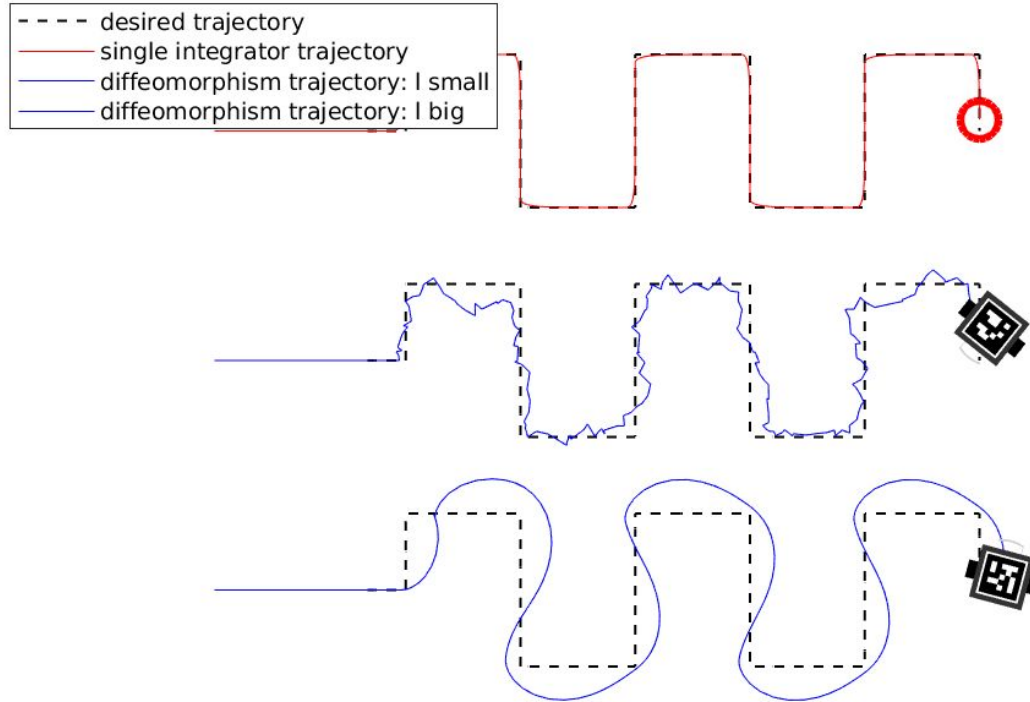


What are the 2 different approaches the authors took to design the collective behavior of the swarms?

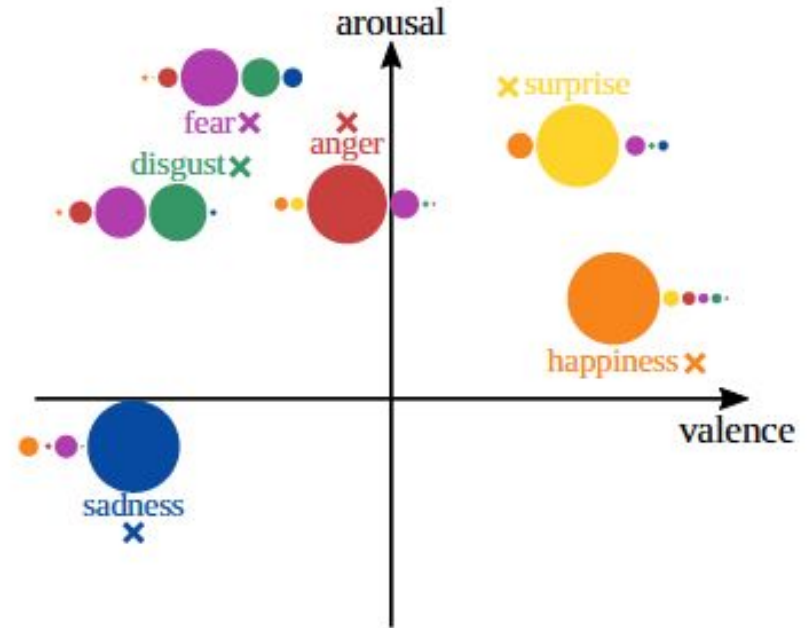
**Design approach 1**

**Design approach 1**

# Robot control laws and Difféomorphism



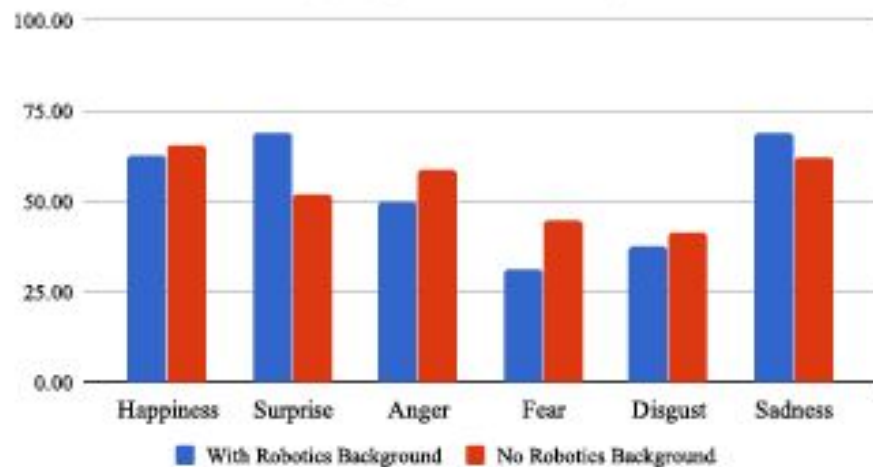
# Study



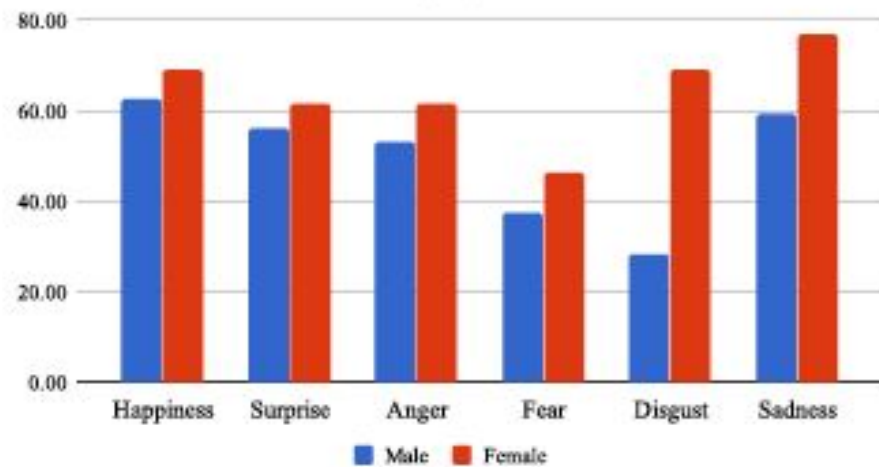
Circumplex model of affect (Russell, 1980)

# Study

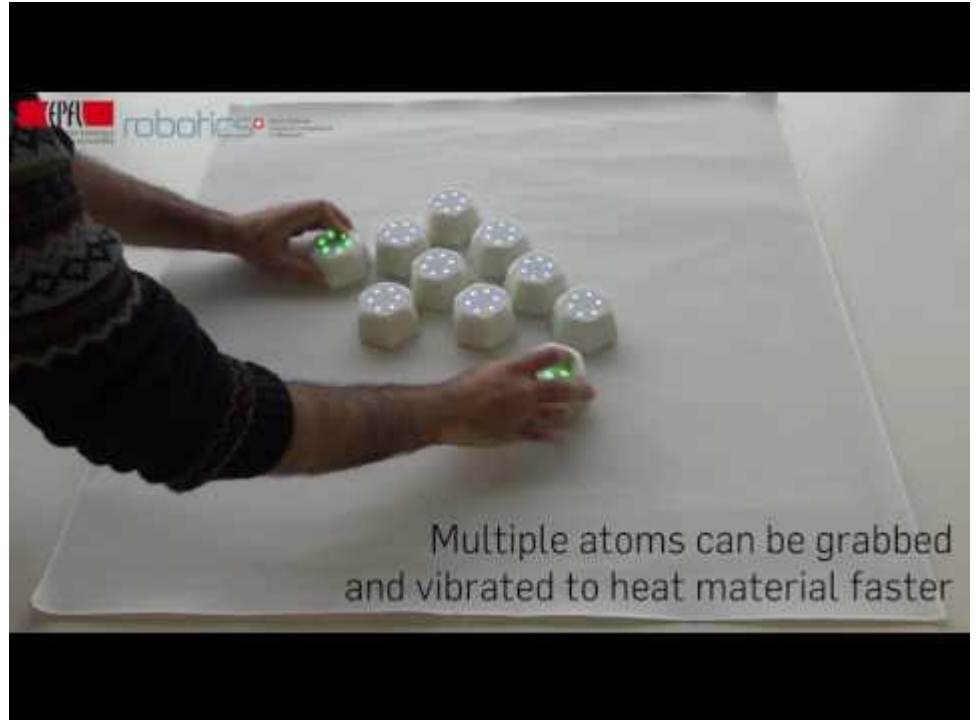
Accuracy (%) by Robotics Background



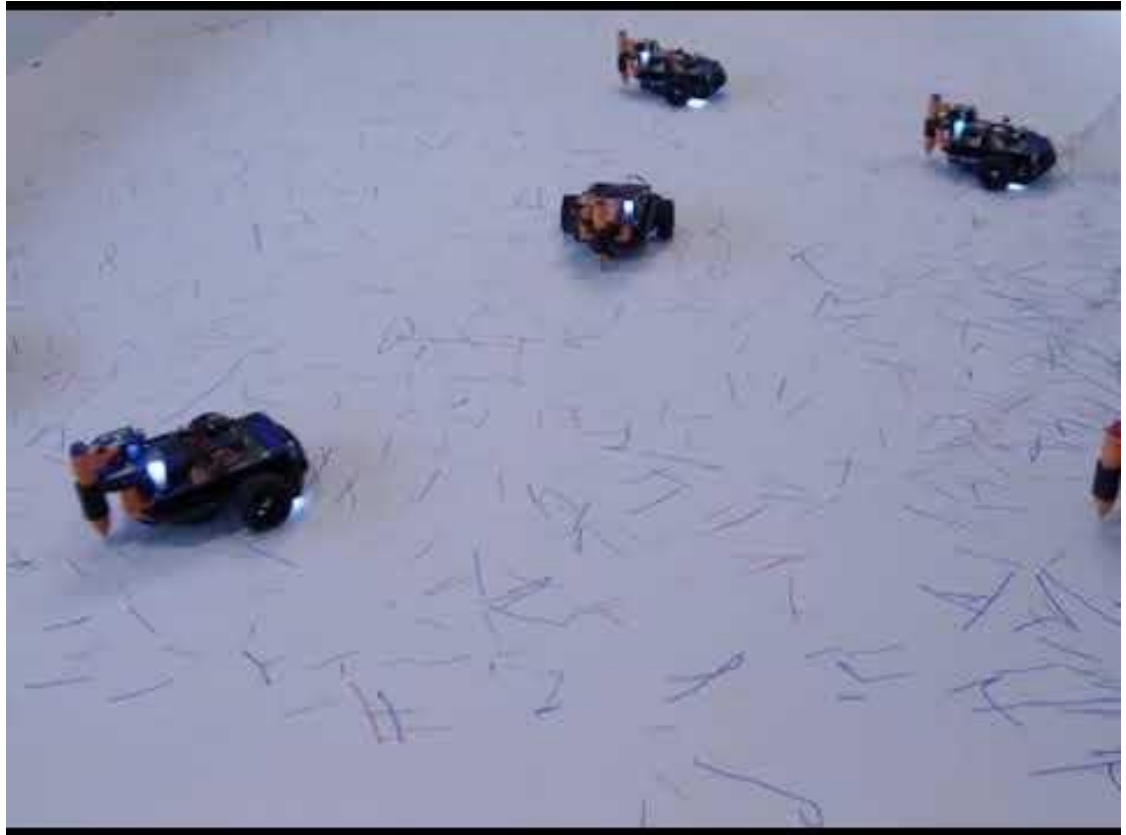
Accuracy by Gender



# Cellulo - EPFL

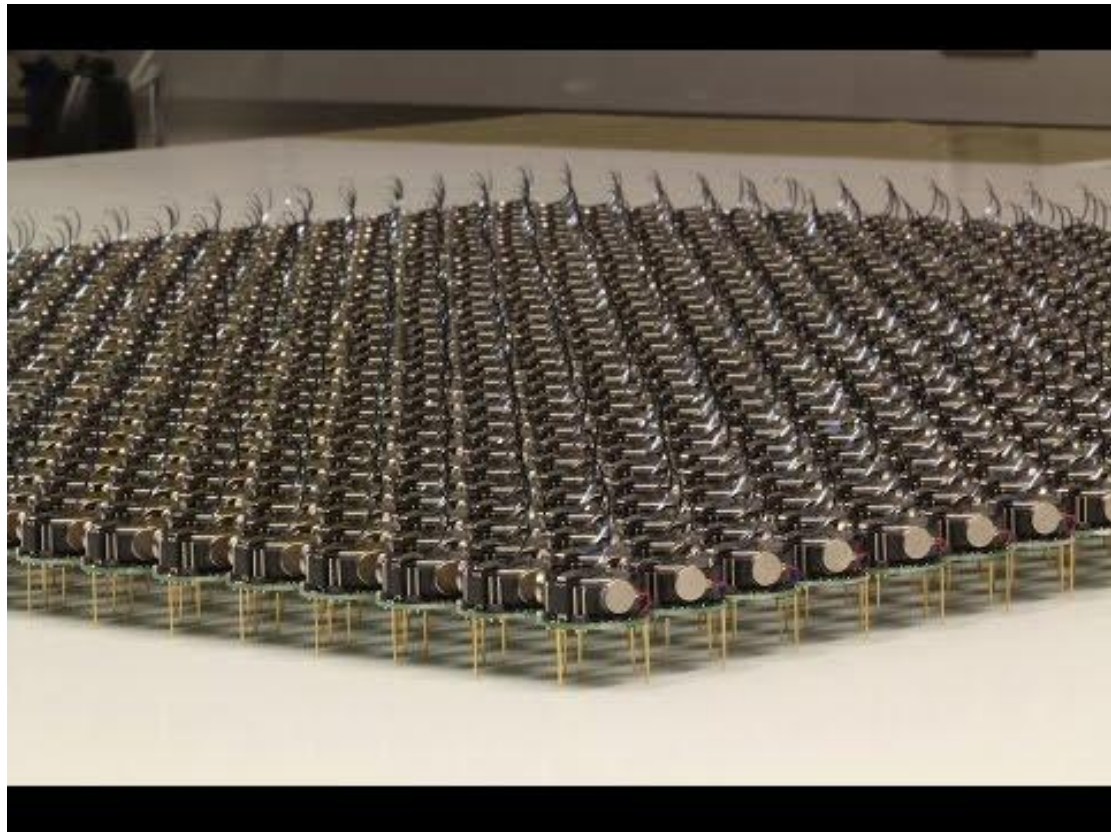


# Leonel Moura - Artist



**Harvard Univ**

- **Shape swarms**



**Activity** - How would you like to use swarm robots?  
For which purpose?  
Which collective behavior they should have?

Social good - Rescue, finding people in a crash

Education - Animal behavior, history

Research - Study of intentions based on movement (ASD children)

Architecture - Bridge-changing shapes (modular robots)



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Meeting #12 (31 May 2019)