



# INTERACTION WITH A PERSONALISED SMART SPACE FOR ENHANCING EVERYDAY LIFE

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# PROBLEM

Place, space, smart space

# SMART SPACE



The concept of smart space characterises a physical place where people and technologies cohabit and continuously exchange information in order to create an interactive space where people's needs and requests are satisfied in an intelligent way.

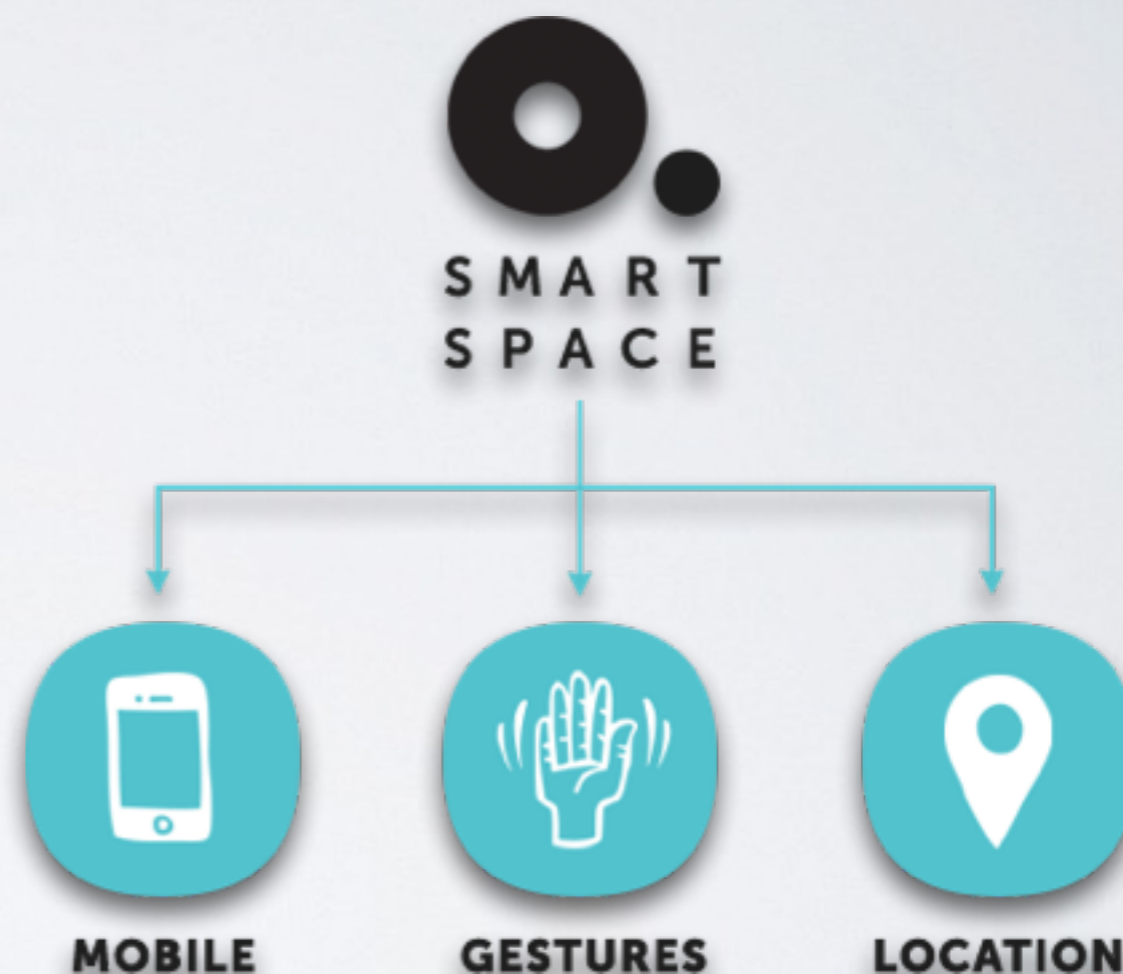
# SMART SPACE/2

Many researches adopted a top-down approach, focusing on embedding smartness in buildings, objects and everyday artefacts.



# SMART SPACE/3

The new properties of this space are changing the way in which people interact with it through body and gestures, requiring people to learn new **artificial** and often **non-natural forms of interaction** in order to be able to interact with the new capabilities of the space.



Introducing technologies in everyday environments makes it harder to maintain these relationships introducing distraction, mediation and overload of information.





In general, technologies are bringing novel interactional modalities in daily routine.



Human beings establish a deep relation with the physical environment in which they live and how, in turn, the environment influences the creation of their own identities and their personalities in the space itself.



# SMART SPACE/5



TOP DOWN

USER-CENTRED DESIGN

BOTTOM UP



# RESEARCH QUESTIONS

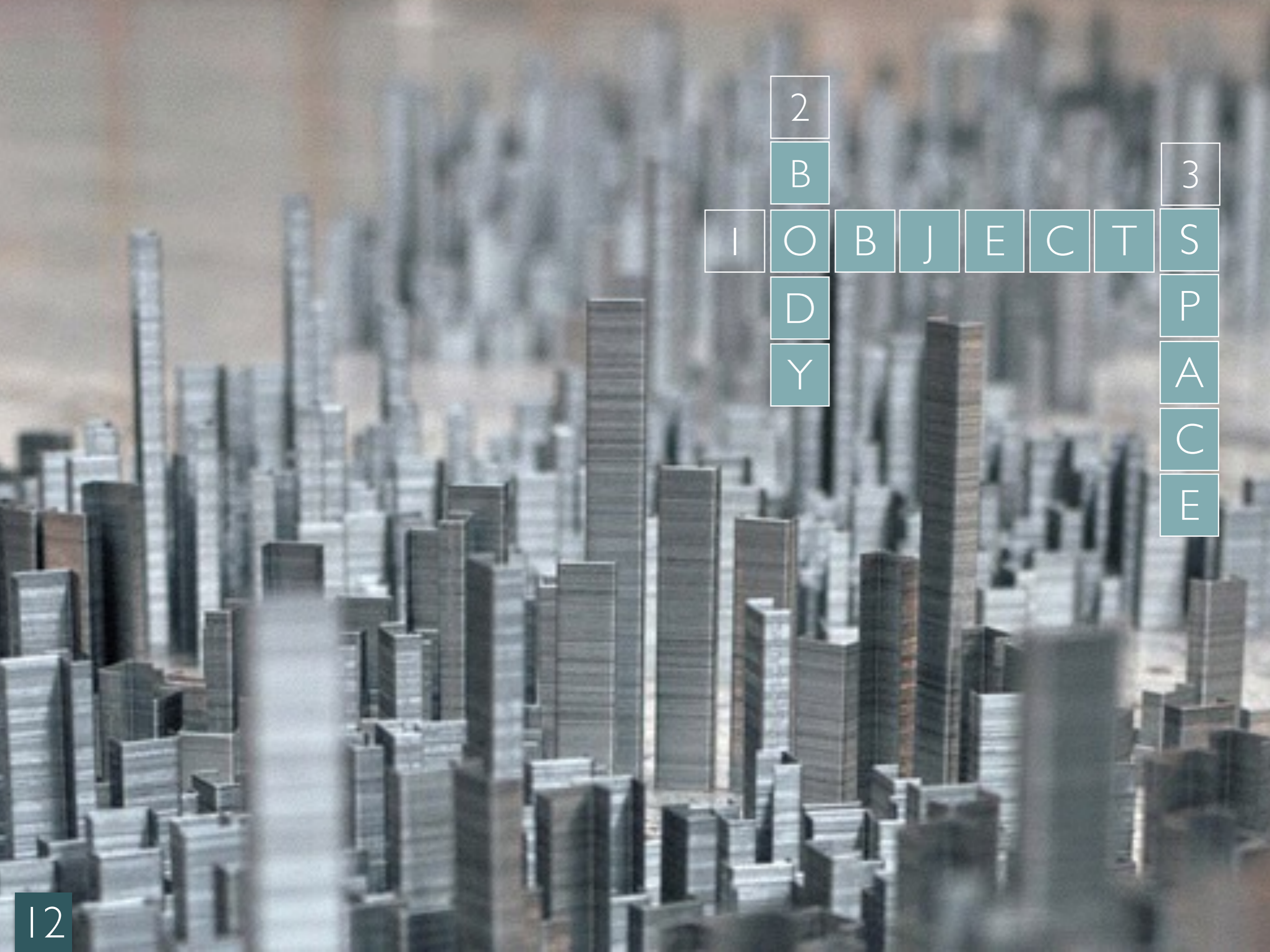
1) to examine the definition of the space and smart space in order to achieve the definition of a personalised smart space;

2) to investigate the relation between human body and space to improve one's ability to interact in a natural way;

3) to present a study for a new gestural corpus and to define new affordances for the PSMA.

# RESEARCH QUESTION/ I

Define the smartness in the space



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# OBJECTS

- **Instruments** designed to accomplish a general or specific task: they can be better defined looking at the actions that people can achieve through them;
- **Cognitive artefacts**, without any necessary physical properties;
- **Processes, rules** and **procedures** to perform an interaction with the environment.

# SMART OBJECT

A smart physical object (SPO) is a tight and seamless integration of a physical and a digital counterpart which augment each other to define a unique peculiar entity.



# SMART OBJECT

- The intelligence cannot be independent of the physical nature of the object: first of all, a SPO is a **physical object** with its physical **nature, properties** and **functions**.
- An SPO can be seen as an **Intelligent Agent** like a computer system that is situated in some environment, capable of autonomous action in this environment in order to meet its design objectives.

We single out six abilities that in our view can concur to defining different forms (levels) of intelligence:

For the **relation** with other obj/SPO/human:

1. object to object interaction,
2. human-object interaction,
3. social, network with objects and humans.

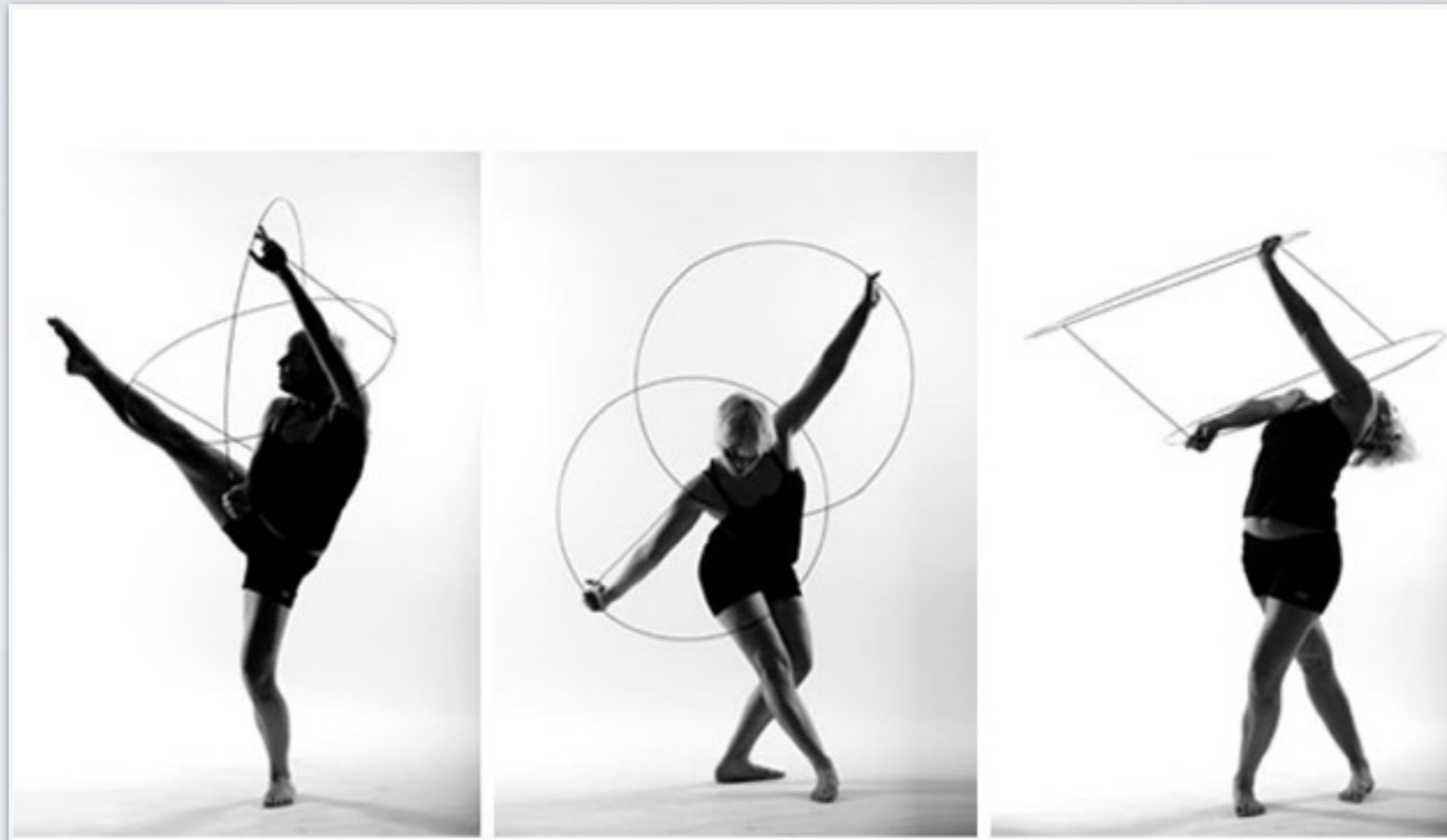
For supporting **intelligent behaviour**:

4. knowledge management,
5. reasoning,
6. learning.

\*Matassa, A., Cena, F., Console, L., Torre, I.: Smart physical objects manifesto. under revision



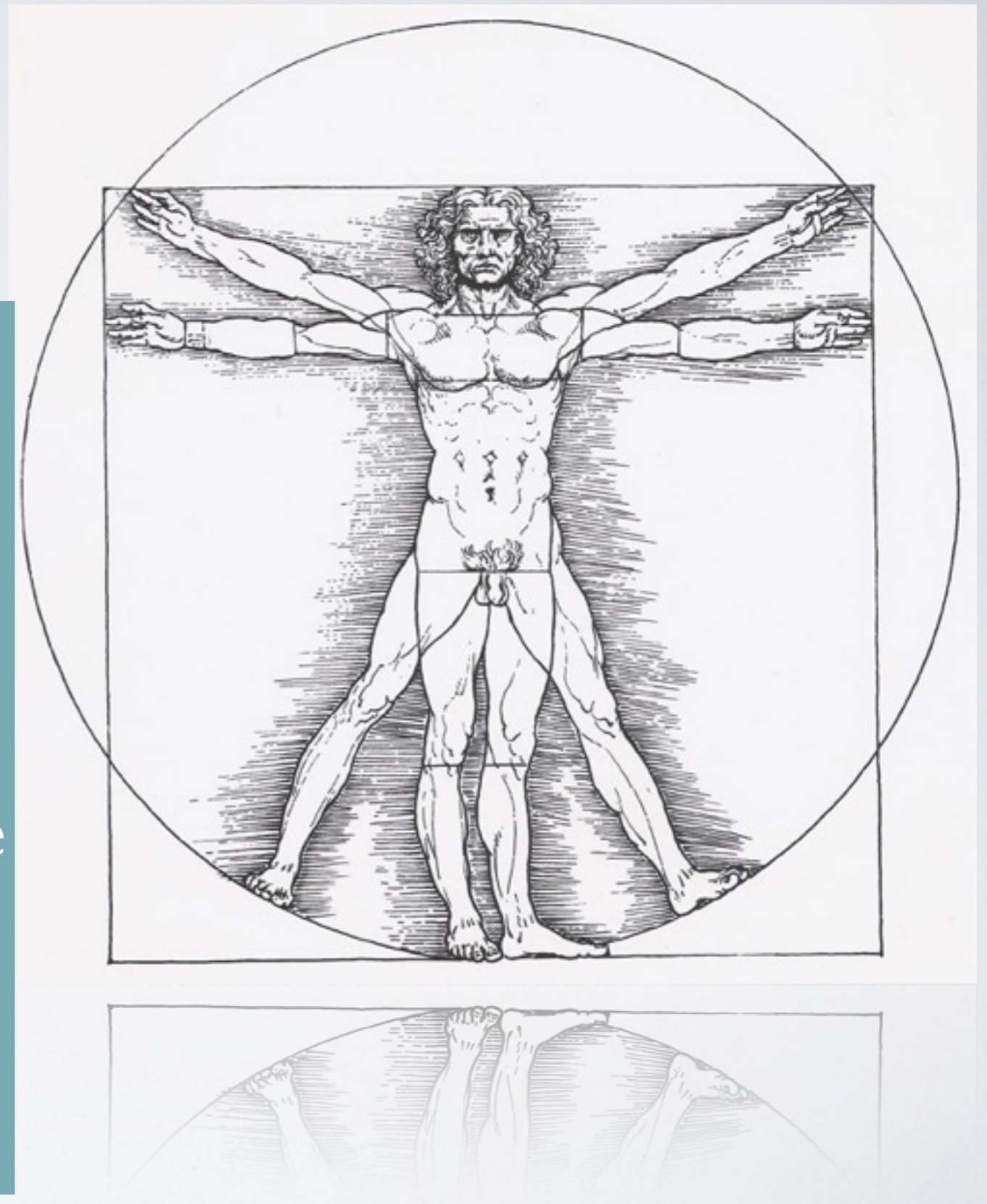
# BODY

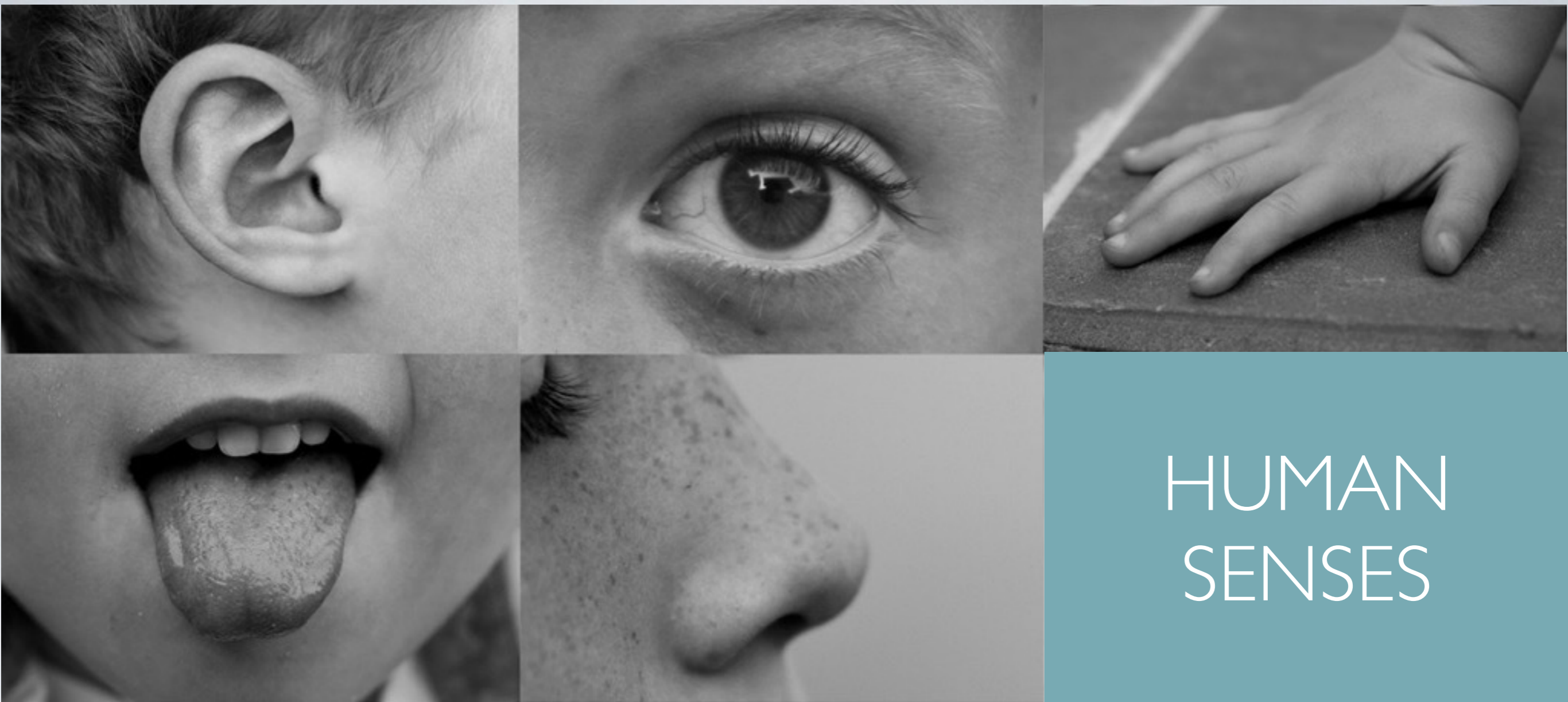


The body exists in its space as an **active** and **living** entity with capabilities to relate to its surroundings through **senses** and **movements**.

# BODY

The body should be considered as an integral part of its environment; the body and space are not separated entities and their **relations** are manifested through human spatial experience.





# HUMAN SENSES

The body already presents a set of special **tools** for interacting with the environment: the **human senses**.

Touching, smelling, hearing, tasting, seeing, exploring the environment with the senses, building knowledge about it.

By using **sensory systems**, the body perceives different kinds of information from the environment, which are essentially complex bits of information consisting of visual forms, colour, light, texture, tone, smell, taste, tactile sensations and others.

# BODY





Through movement, the human body develops **awareness** of space and acquires a sense of direction, while sight provides the human body with an understanding of space in three-dimensions and touch allows the **manipulation** of spatial objects with various physical properties (through affordances).

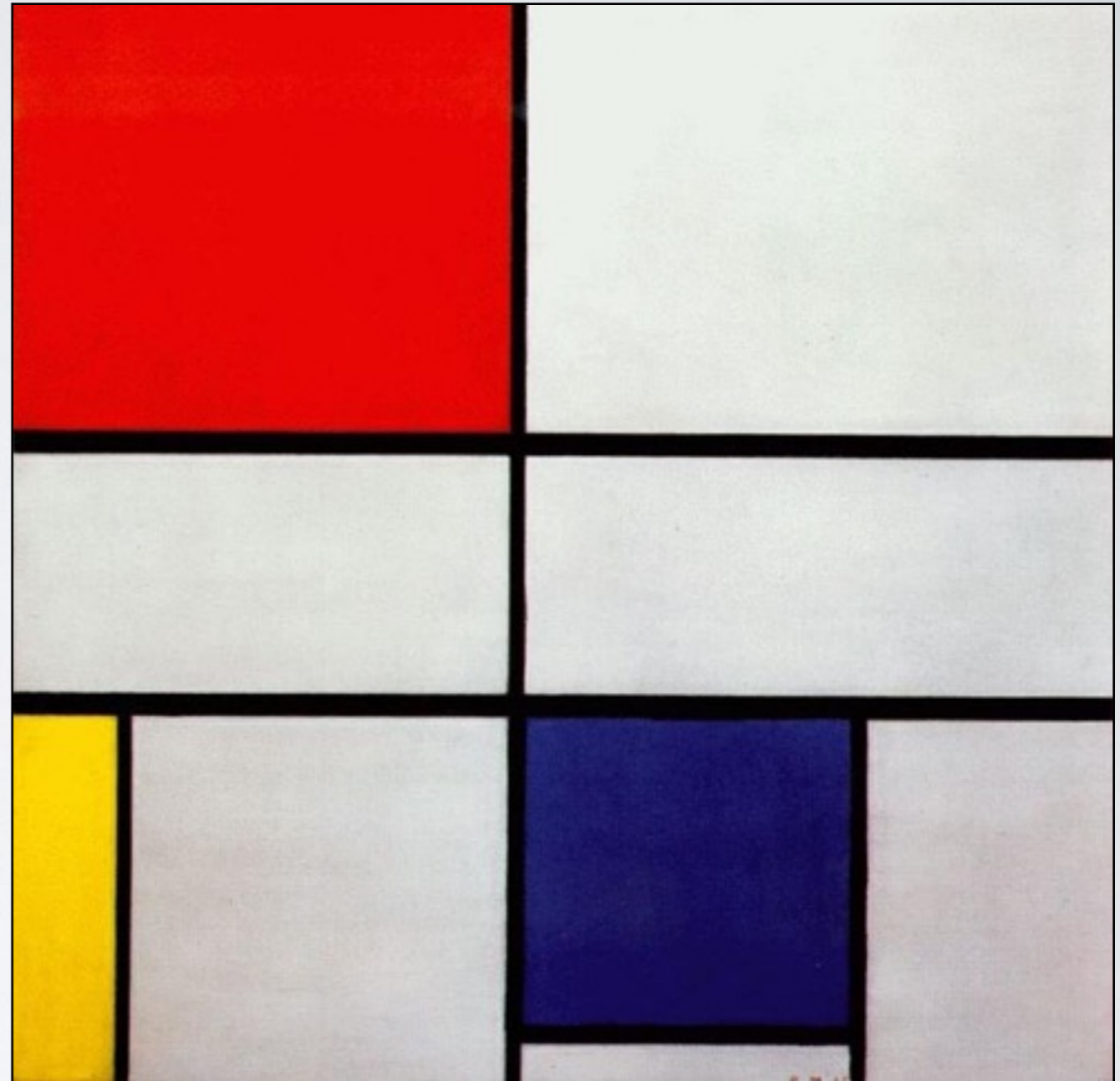


# SPACE

1. Space as an **empty area** between things,
2. Space as the **distance** from other people or things that a person needs in order to remain comfortable
3. Space as composed by object, body and space itself.

# SMART SPACE

Smart space (SMA) as a **composite object** (SPO) whose intelligence derives from the aggregation of the level of intelligence of the composing objects.



*The level of intelligence of the SPO is more than the aggregation of its components.*



## PERSONALISED SMART SPACE

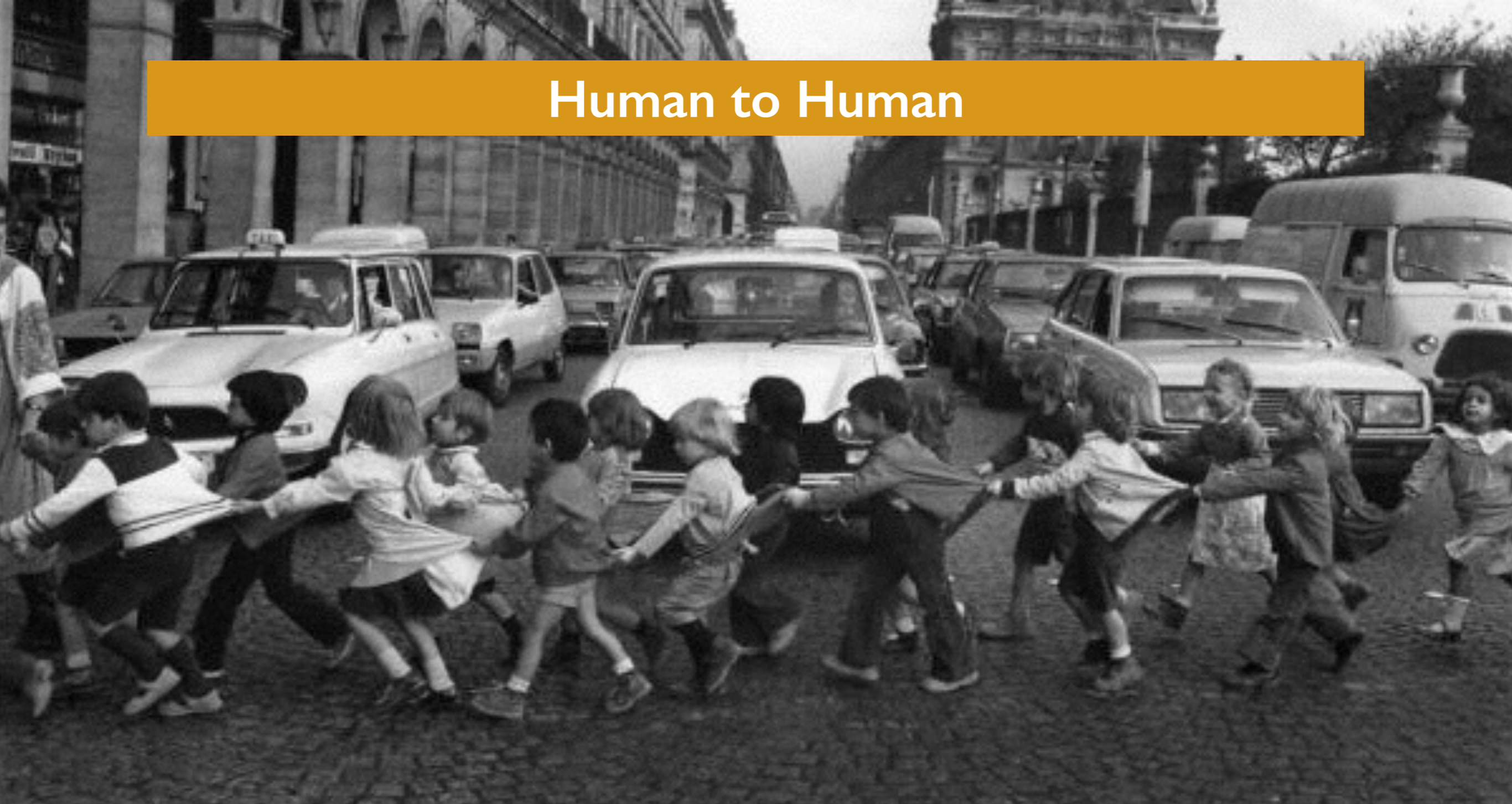
is a complex system where human body and SPOs cohabit in a shared experienced space with a continuous exchange of information according to the needs of each individual. It is especially characterised by the capability to **adapt** in order to accomplish the individual **needs, preferences**, requirements of each single **user**, becoming able to reflect her **personal experiences**.



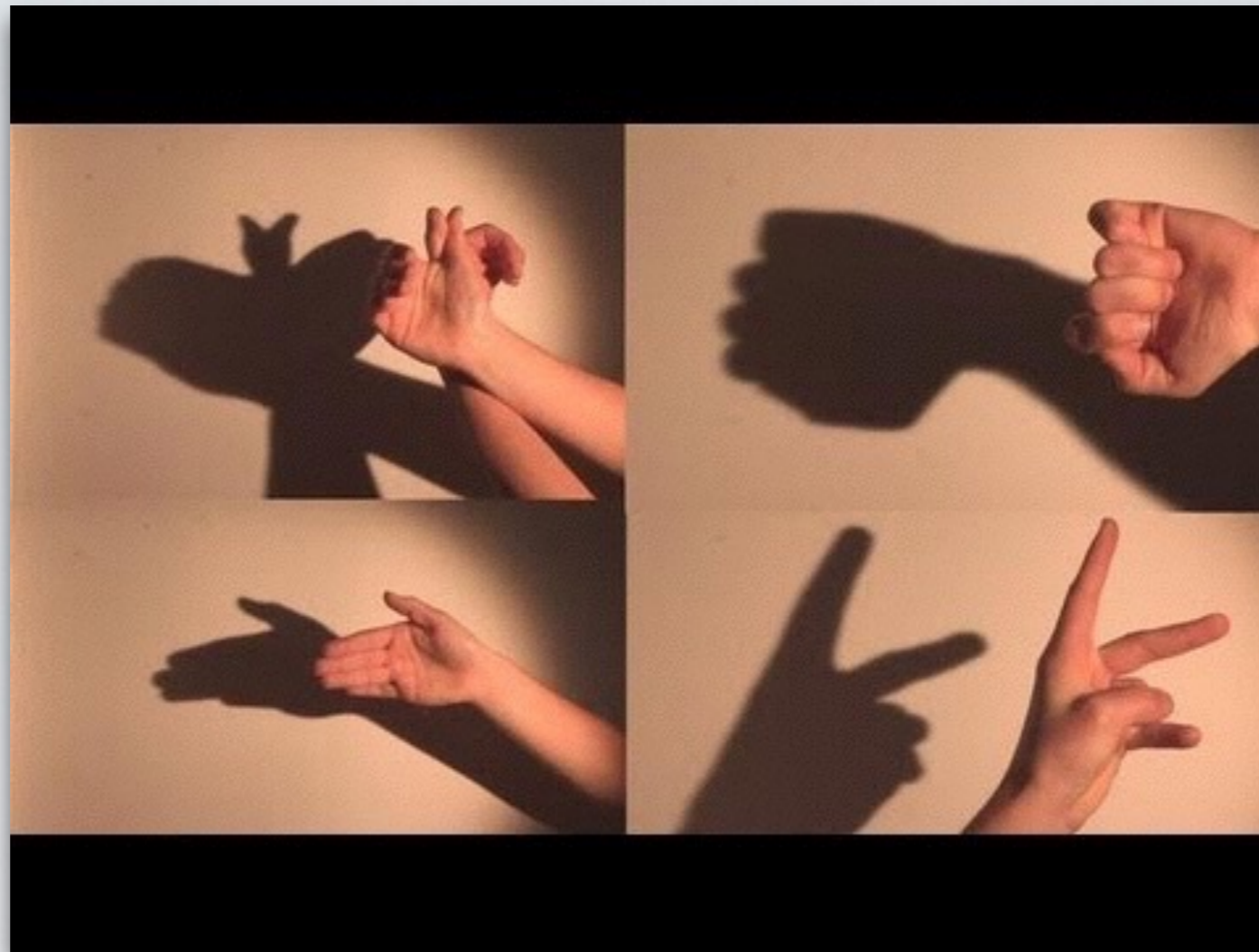
# RESEARCH QUESTION/2

Designing a new natural interaction paradigm

# Human to Human



**Social Space** is the place where people interact to each other, using artifacts (digital and non- digital) as means of communication.



The interaction practices can be collected in a **gestural system** as a nonverbal shared language, made on a set of symbolical signs and codes, known in a specific social space, that enables the communication between people without any additional components.

# SYMBOLIC INTERACTION

There is a set of gestures that people perform toward artifacts on the basis of the meaning that they have for people. Through these gestures people are engaged in a **non-verbal conversation**, a “conversation of gestures” that allows them to interpret these gestures as significant symbols.



## Human to Object



The notion of affordance, introduced by Gibson (1979), suggests that the **sight** of an object implies the **immediate** and **automatic** selection of its intrinsic features that facilitate our interaction with it.



These features are not just about mere physical properties; rather, they embody the **action opportunities** that an object or an environment may offer to an individual who is able to use and perceive them.

# SPATIAL AFFORDANCES

- Chemero (2003) emphasised that affordances are not properties of the environment only, but they are essentially located in the **relations** between the **body** and **environment**.
- Affordances depend on both the properties of the person as a user and the properties of the environment or its artefacts.



Space

Body

Object

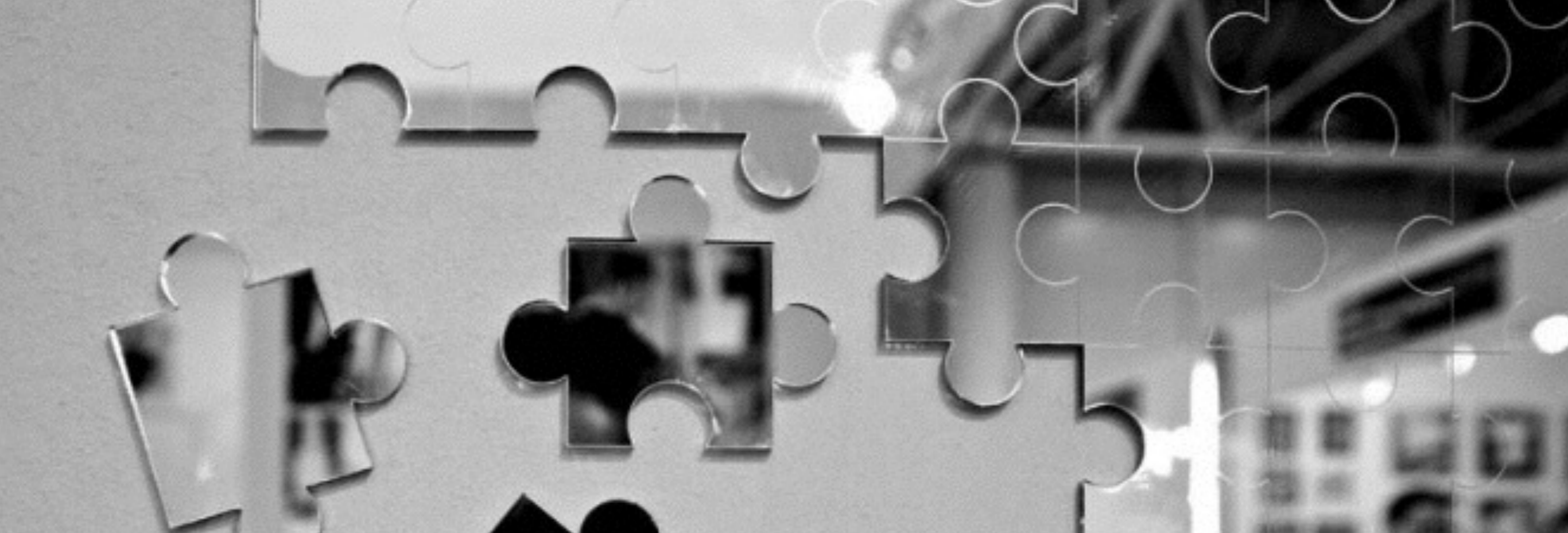
The affordances should not be limited to the facts that different spaces and objects allow the emergence of a certain human actions, but it is necessary to look into the **relations** that occur between the **space, body** and **object**.



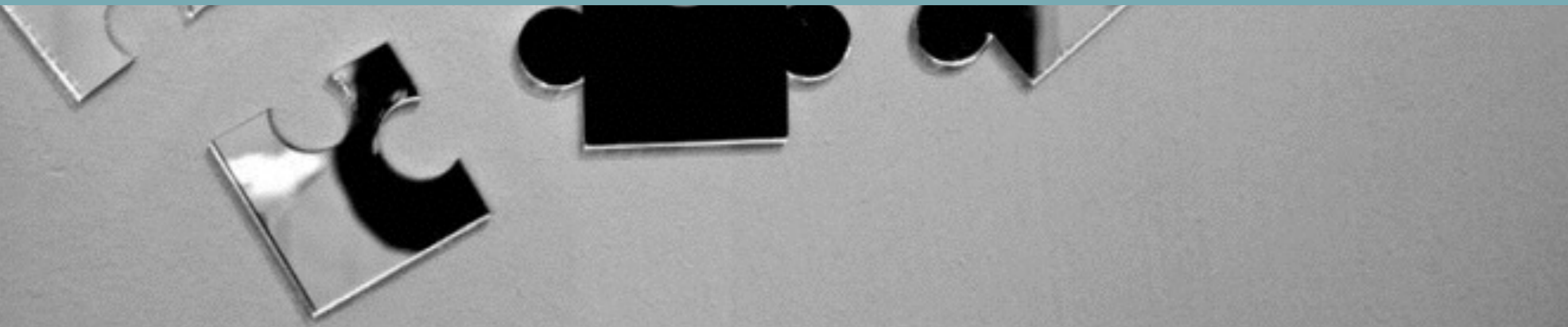


The human body, in the process of perceiving an affordance, also involves an **awareness** of the relational **role** of the **body** and **space** from which the possibilities of action could emerge.

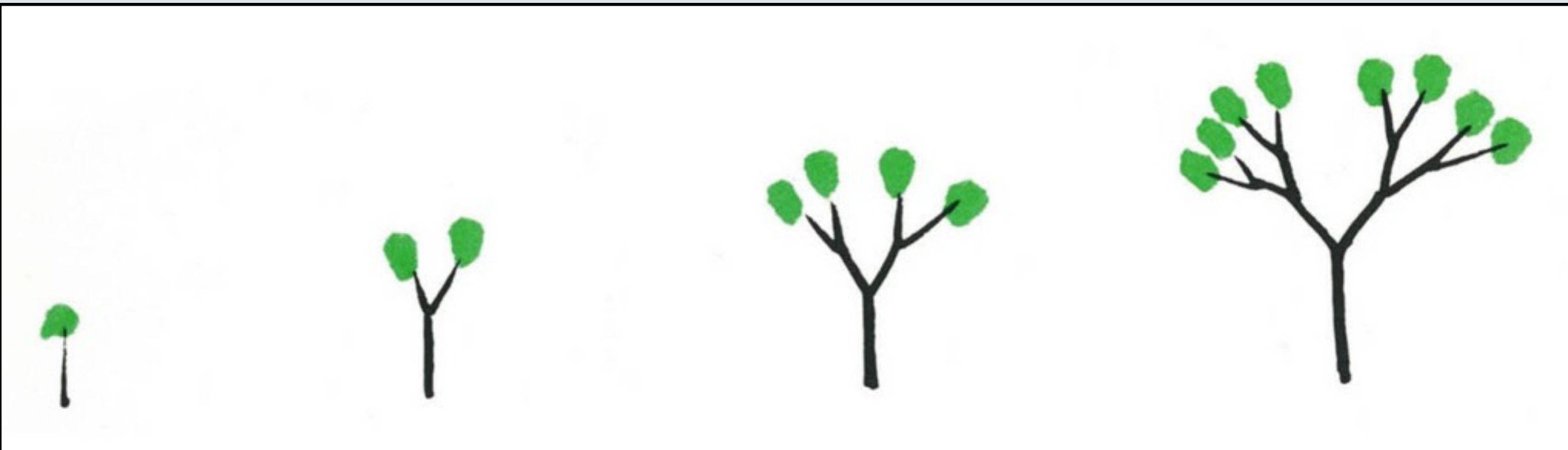
The idea of space as a possibility for actions suggests that the body as an **active actor** that could adapt his/her action in order to respond to the situation.



We claim that as a smart space is a **composite object** whose intelligence derives from the aggregation of the levels of intelligence of the combining objects.



# SPATIAL AFFORDANCES

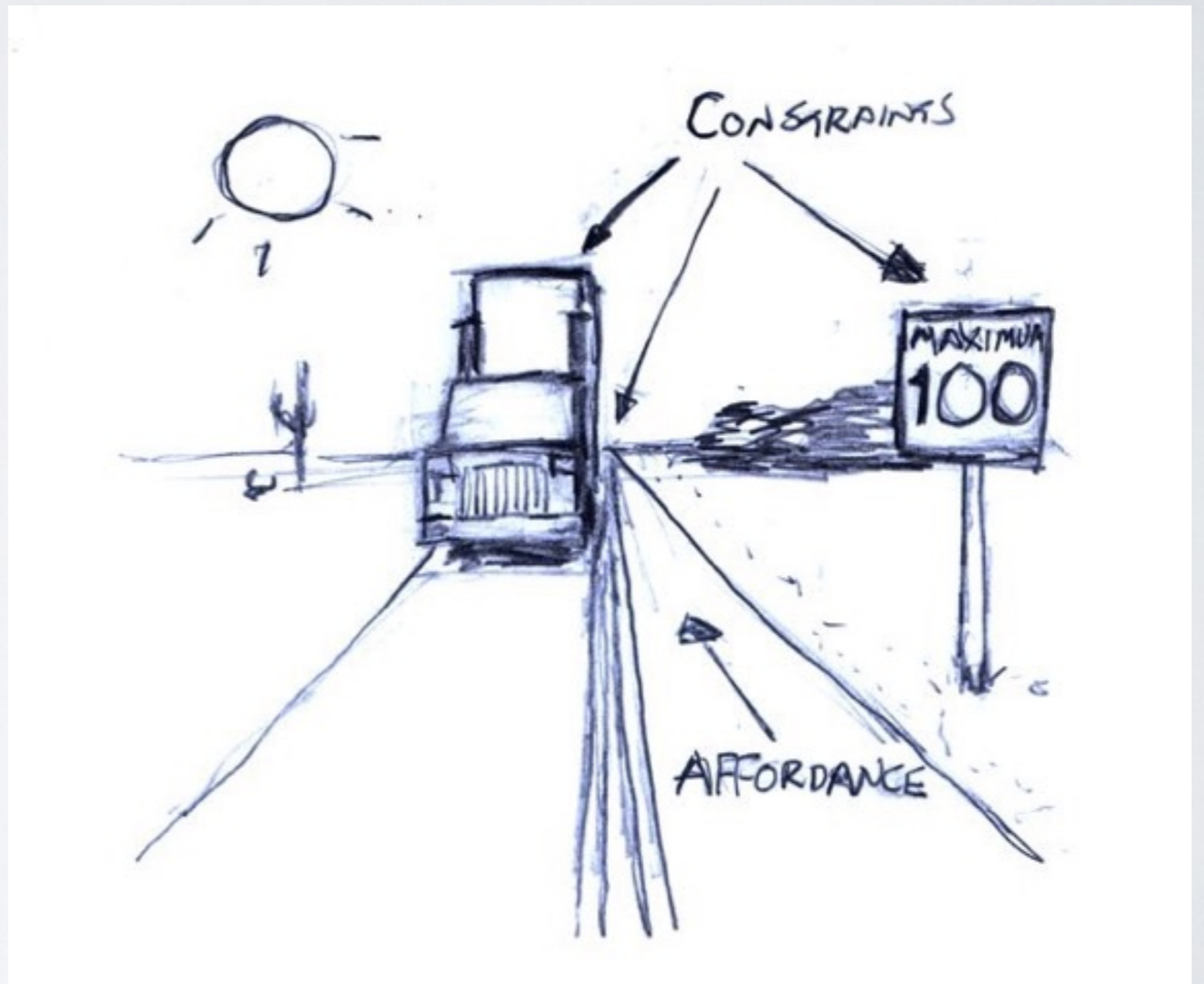


The vision of a space as an **aggregation** of objects allows to consider the presence of **a set of affordances** in it.

The spatial affordances are composed by the **combination** of affordances already existing in objects and they would be the **key** to allow a natural interaction for humans in a SMA and PSMA.

# MULTIPLE AFFORDANCES

- SMAs are formed by a set of affordances in a sequence of affordances. they are characterised by **multiple affordances**.
- The activation of affordances depends on the **task** and **situation** in which an affordance might be activated when there is certain task assigned for utilising the affordance.





Designing **affordances for smart space** is essentially designing for the **body-space relations** or, more specifically, designing the properties of the space that promote a natural body interaction.

# RESEARCH QUESTION/3

Study to find a new interaction corpus for PSMA

# OUR EXPERIMENT

We propose a study in order to understand the new interaction modalities in a social smart space and to design an innovative code to allow a natural interaction and communication using technologies based on three main steps.



# EXPECTED RESULTS

1. Define and create a **PSMA** based on the personal users' preferences.
2. Re-design a **system of meaningful interaction modalities** for humans in order to enable a **natural interaction** between body and space exploiting **gestures** and **affordances**.



I. Smart space as a composite object whose intelligence derives by the aggregation of the level of intelligence of the composing objects.

Decompose intelligence along a set of concrete abilities and to identify the granularity of smartness, and characterise intelligence in objects as the “ability of an entity to exploit knowledge in problem solving tasks, possibly in response to some external stimulus and/or performing some action and/or interacting with other objects or people”.

2. Personalised smart space as the **smart setting** based on the users' preferences.

Adopting **User Modeling** for creating and maintaining a model of the user, with information about its preferences, interest, etc.  
Then, aggregating single user models in order to model a personalised smart space for each single user.

### 3. Designing affordances for the PSMA to promote a natural body interaction

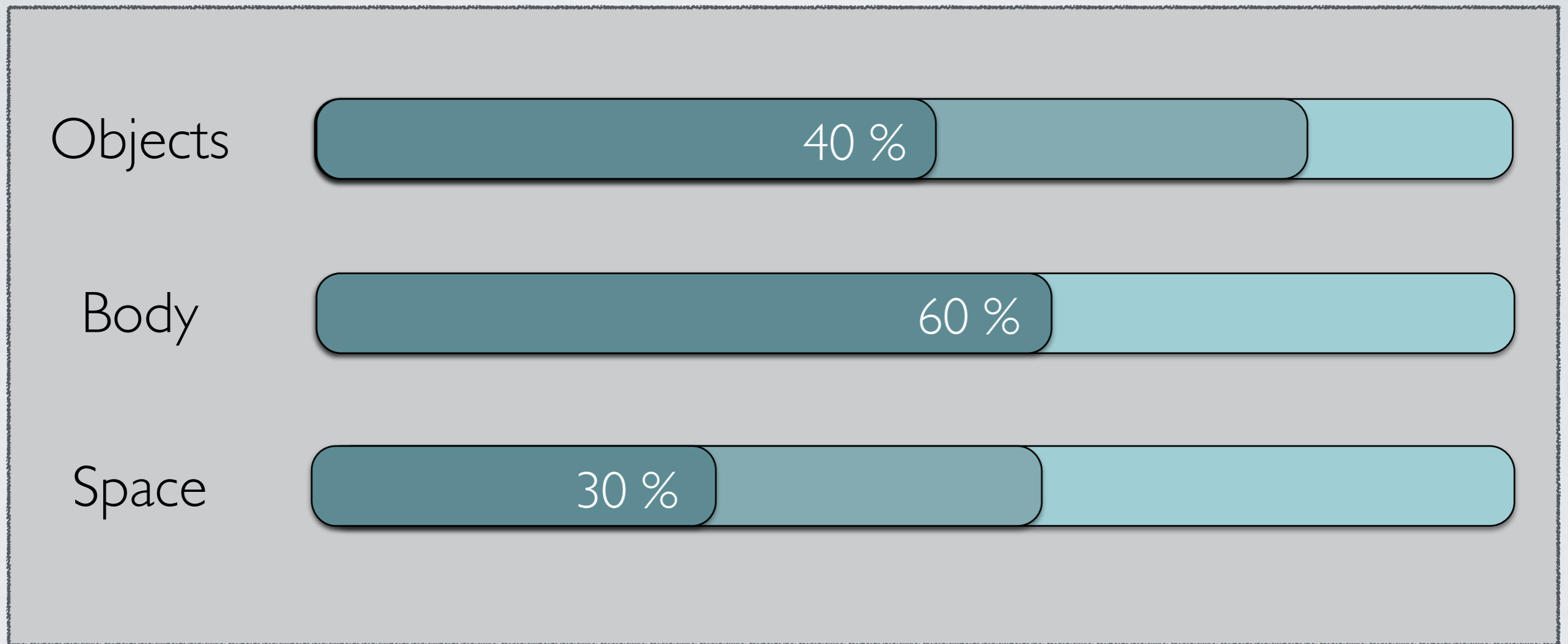
**3.1.** Through an **observation in situ**, select a set of **gesture** performed in a specific social space using an everyday objects and the related **affordances**.

**3.2.** Giving to the users a smart object, observe how users interact with it and adopt it in everyday activities. We will exploit two specific techniques: **bodystorming** and **experience prototyping**.

### 3. Designing affordances for the PSMA to promote a natural body interaction

Exploiting the affordances and gestures, we claim to restore a **natural mapping and relation** between **spatial features** and **users' needs**, according to the enhanced capabilities existing in space, body and objects.

# RESEARCH STATEMENT



Thank you for the attention!

Q&A

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