

“Pebble Box”

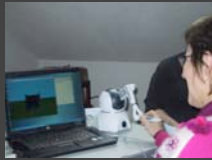
“Exploring and Acting on Multiple Moving Multisensory Objects”

Perception and cognition from virtual thingy (VT)
VT as a lab. To know the process of constitution of “object”



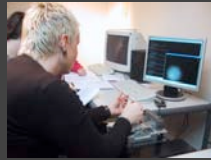
Tangible Pebble Box

Real manipulation
Changing the **SOUND**



Virtual Pebble Box 2

VR Haptic manipulation
Changing the **VISUALISATION**



Virtual Pebble Box 3

VR Haptic manipulation
Changing the **MATTER**

“Pebble Box”

“Exploring and acting on Multiple Moving Multisensory Objects”

Subjects manipulate real pebbles in a box.



Tangible Pebble Box

Real manipulation
Changing the **SOUND**

The sounds produced are picked up by a microphone and analyzed by a software that extract “sounds grains” events . Sound grains events extracted features are rate, amplitude, density.

These new signals are used to control and trigger recorded synthesized sounds as:

- Bird songs
- Water sounds
- Crunching apple sounds
- Sandpaper
- Tap dancers
- Coins sounds

“Pebble Box”

“Exploring and acting on Multiple Moving Multisensory Objects”

All People tries to infer a possible scene in order to be able to associate the action to the sounds.



Walking with pebbles and firing birds in bushes

Inference of a possible scene in accordance with the exploration strategy Created scene

With bird songs

People imagines “walking on a gravel path or throwing a stone, triggering panic on birds nested in bushes, and they mimic a gesture to walk with hands

With water sounds

Water sounds: People imagines “handling stone(s) in water or disturbing animals (fishes) which escape”.
Gesture to throw pebble in water,
Gesture of « swimming with hands »

With Crunching apple sounds

Crunching apple sounds: People imagines “an animal within the box and becomes anxious”.

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All People tries to infer a possible scene in order to be able to associate the action to the sounds.



Crunching an apple with pebbles

With Crunching apple sounds

Crunching apple sounds: People imagines “an animal within the box”.

Gesture to scratch a box in which there is an animal or unknown living organisms nested.

This means that the inference of possible scene is a dynamic evolving process. It alternates scene hypothesis and exploration of way of manipulation in order to converge to a more believable inferred scene by means of Emergent Exploratory Procedures.

Even if what it happens is surprisingly, more or less all the « scenes » sound as believable: people adapt himself in order to create a believable scene.

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People handles 10 3D physically-based cubes or spheres, simulated by the Open Dynamics Engine software. He stirs up within the pebble box by means of a Phantom Omni device.



Virtual Pebble Box 2

VR Haptic manipulation
Changing the **VISUALISATION**

Sounds of collisions are triggered by collision detection algorithm.

Visualization is changed:

- 2 or 10 objects are visually represented
- the manipulator is visible or not
- Physical (haptic) cubes are visually represented as spheres or as cubes
- Physical (haptic) spheres are visually represented as cubes or spheres
- Visual size is greater, smaller or equal to haptic size

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Here too, people tries to infer a believable scene, if possible multisensory, and if not, by eluding some modalities (not always the same):



When eyes closed: Field vs. object

(1) People infers a phenomenon rather than « clearly cut objects », when no visualisation. ... Created scene

Examples

In addition to clearly cut objects feeling, people talk about « force field », « magnetic field », paste, medium resistance, grain in paste, etc...

When visual objects are smaller than their physical radius, the physical inferred objects are supposed surrounded by a transparent shell or extended by a force field.

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People tries to infer a believable scene, if possible multisensory, and if not by eluding some modalities(not always the same):



With and without oneself visible representation

(2) Subjects change the way they manipulate when they have visual perception of themselves (EEP)

Examples

They explore the space

They attempt to create the conditions allowing them to explore the shape of the supposed objects.

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Virtual Pebble Box 3

VR Haptic manipulation
Changing the **MATTER**

A 2D Virtual Pebble Box is modelled by physically-based software CORDIS-ANIMA. It is composed by a physical circular box containing 8 mobile masses. All objects interact by visco-elastic collision interactions. People stirs up within the Pebble Box by means of an ERGOS haptic stick.

The physical parameters interactions are changed:

- Elasticity (rigidity)
- Viscosity
- Interaction radius

Two visualizations are used:

- a ball like visualization
- a blurred visualization

Sounds are produced by the masses collisions

“Pebble Box”

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People tries to infer a believable scene, if possible multisensory, and if not by eluding some modalities(not always the same):



Virtual Pebble Box 3

VR Haptic manipulation
Changing the **MATTER**

(1) The value of physical material interactions leads to infer two types of very different categories of scene not necessarily similar than the objective one

Examples

People feels a kind of « medium », « paste, « force field », « coton », etc. when grains are in soft colliding interactions

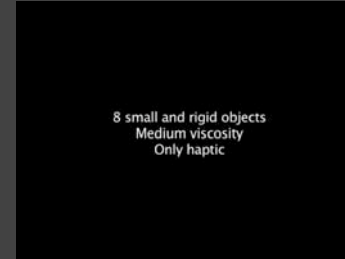
People feels clearly-cut objects but not necessary all of them or of the same size.

When the sound or the vision are not consistent, they are preferably eluded.

“Pebble Box”

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People tries to infer a believable scene, if possible multisensory, and if not by eluding some modalities (not always the same):



Virtual Pebble Box 3

VR Haptic manipulation
Changing the **MATTER**

(2) The dynamic of the coupling of the manipulation, mainly the type of grasping - more or less strong - depends of the implemented scene. People adapt his own dynamic and the dynamic of coupling to the physical constitution of the manipulate object. Gesture adaptivity ... Dynamic Manipulation Adaptation.

Examples

When objects are in strong rigid interaction, people grasp strongly the device and act (press, move) with high energy

When objects are in soft elastic interaction, or when they are very small, people manipulate more delicately for example by grasping the stick by fingers

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People tries to infer a believable scene, if possible multisensory, and if not by eluding some modalities(not always the same):



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(3) The refinement of the exploration increases along experience and the scene inferred may change progressively. Learning adaptivity.

Examples

Very soft matter

People start by feeling nothing and progressively go to conclude to a type of « resistant or viscous » field, or field with lumps

Very rigid matter and big objects

People starts by feeling « one big object », exploring its shape and progressively discover eventually the others, that are imagined smaller than they are.

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In all the cases, with all the persons, an inferred scene is constructed **from** experience.

This constructed scene can be different from the objective scene. It is a **Created Scene**.

By way of three complementary strategies

- Emergent Exploratory Procedures (EEP)
- Dynamic Manipulation Adaptation (DMA)
- Adaptive Experimental Learning (AEL)



Enactive concept:

« Representation of the world does not preexist ... »



Inferred objects change with the experience

... Most of the time, inferred objects are Believable

More than a tool to simulate reality (i.e. mechano-optivcal world) to perform more easily experiments, Virtual Thingy - including simulation and all the devices (sensors and multisensory actuators) are tools to explore the process of emergence of cognitive categories able to be called "objects".

THANKS

"Pebble Box" "Exploring and acting on Multiple Moving Multisensory Objects"

Ergotic / Non Ergotic Interaction



Tangible Pebble Box

Non-ergotic relation to the sound
Combination of Semiotic gestures And Epistemic Hearing



Virtual Pebble Box 1

Ergotic relation to the image
Non-Ergotic relation to the sound (Light ergotic)
(supplementary Semiotic And Epistemic functions)



Virtual Pebble Box 2

Ergotic relation to the sound and to the image
(supplementary Semiotic And Epistemic functions)