

# **THE RECORDING OF OBSERVATIONAL BEHAVIORS IN VIRTUAL IMMERSION: A NEW RESEARCH AND CLINICAL TOOL TO ADDRESS THE PROBLEM OF SEXUAL PREFERENCES WITH PARAPHILIACS**

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# 1.Theoretical and empirical background

## 1.1- Paedophilia: numbers

- Needless to say, paraphilias, and especially paedophilia, are major concerns for mental health services and public safety
- Incidence of paedophilia:
  - Finkelhor (1994): USA: 2,4 cases of sexual abuses per 1000 children
  - Trocmé et al. (1994): Canada: 1,57 cases of sexual abuses per 1000 children
  - 27% of all women and 16% of all men reveal that they have been sexually victimized during childhood or adolescence

# 1.2-Sexual preference assessment

- Sexual preference hypothesis (physiologic-behavioral hypothesis): sexual deviance results from the conditioning of the sexual response with abnormal sexual stimuli (Marshall et al., 1999; Mc Guire et al., 1965)
- The sexual preference hypothesis needs operational measurement tools to be based on (McGuire et al, 1965; Laws and Marshall, 2003)
- Kurt Freund (1957, 1963) developed the penile plethysmography (PPG) assessment procedure, followed in the sixties by Bancroft and his colleagues
  - Presentation of **slides and videos** with sexual content to prompt sexual arousal
  - Simultaneously, physiological measurement of the erectile response is performed
  - Averaging of the erectile response across categories of stimuli to establish sexual preferences, particularly in terms of age brackets and genders

## 1.2-Sexual preference assessment (ctnd)

- PPG is the standard in assessing the degree of sexual deviance and the effectiveness of behavioral therapies (ATSA 1997)
- Shortcomings that come with PPG (O'Donohue and Letourneau, 1992; McConaghy, 1989),
  1. Ethical concerns with the use of real child models
    - Victimization of the models used in the pictures presented with PPG
    - There is a need for a replacement of these pictures of real children (Laws and Gress, 2004)
  2. Voluntary erectile control is major threat to the internal validity of PPG (Freund et al., 1988; Harris et al., 1999; Lalumière and Quinsey, 1994; Proulx et al., 1993; Wislon, 1998)
    - There is a need for a device to scrutinize the attentional content of the assessee

## 1.3-Getting round PPG's shortcomings

- To eliminate children's victimization through the use of real children pictures with PPG, resorting to sexual synthetic characters is put forward
- In order to monitor and avoid patients' voluntary erectile control during PPG's procedure, combining visual displays (standard monitor or head mounted displays) with eye-tracking systems is proposed
- Hypothesis: compared to PPG, eye movements could be in themselves as much, if not more, diagnostic of sexual preferences

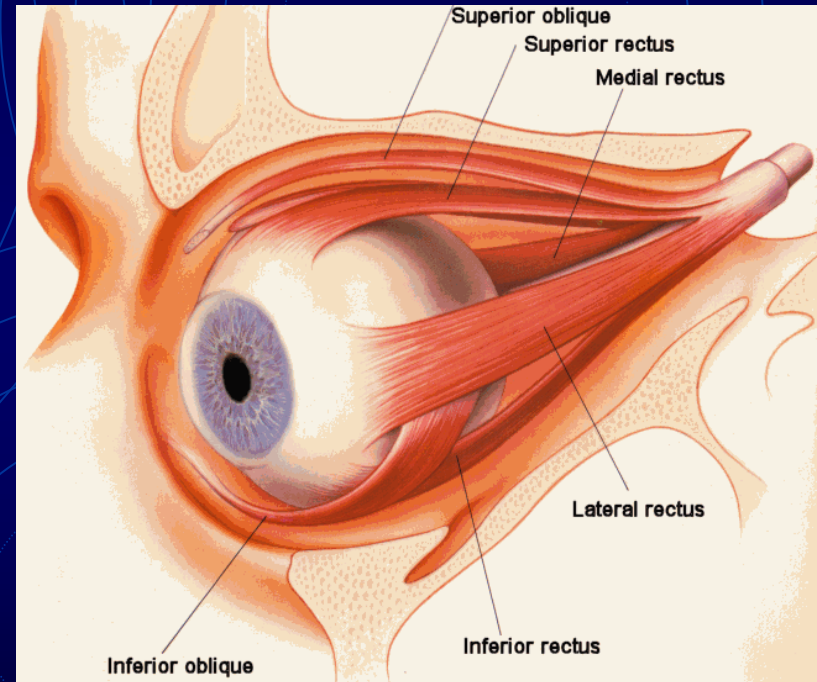
# 1.3.1-Eye movements: probing attentional content

- **Saccades:**

- rapid movements of the eye to search a visual scene
- greater than 1.2 degrees
- voluntary but ballistic, i.e. once initiated they can not be controlled
- Eye movements can go as fast as 800 degrees/second (Thiele et al, 2002)

- **Fixation:**

- the steady gaze holding over stationary objects
- fixation time ranges from 150ms to 600ms with an average of 300ms (Duchowski, 2000; Irwin, 1992; Viviani, 1990)
- fixations are required to extract relevant visual informations



<http://www.sheinman.com/Aanatomyp13.htm>

The background of the slide is a dark blue color. It features three sets of concentric circles, each consisting of four thin, light blue lines. The circles are arranged in a triangular pattern: one set in the top left, one in the top right, and one centered at the bottom. The text '3-Apparatus and methods' is written in white, sans-serif font, centered horizontally across the top half of the slide, overlapping the top two sets of circles.

## 3-Apparatus and methods



The background of the slide is a dark blue color. It features three sets of concentric circles, each consisting of four circles of increasing size. The circles are light blue and are arranged in a triangular pattern: one set in the top left, one in the top right, and one centered at the bottom. The text '3.1-Stimuli: sexual avatars' is written in white, bold, sans-serif font, centered horizontally across the top half of the slide, overlapping the top two sets of circles.

## 3.1-Stimuli: sexual avatars

### 3.1.1-Adult female avatar



## 3.1.2-Adult male avatar



### 3.1.3- Child female avatar



### 3.1.4- Child male avatar



### 3.1.5- Sexually neutral avatar



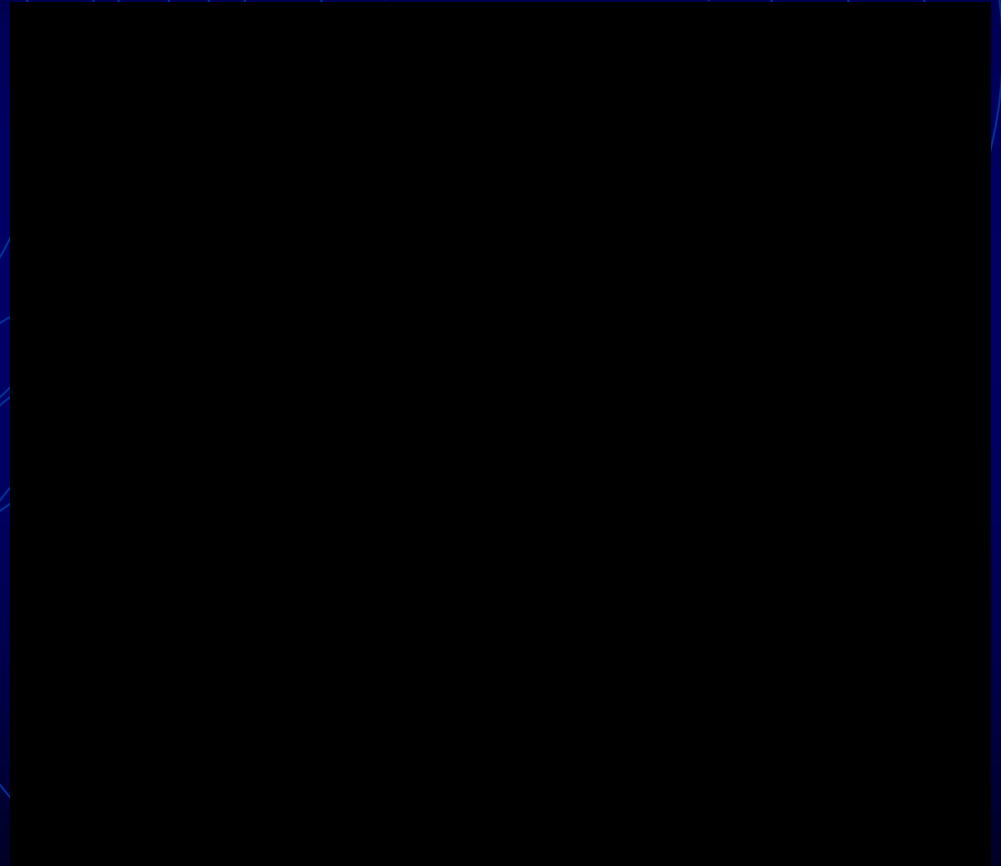
The background of the slide is a solid dark blue. Overlaid on this background are three sets of concentric circles in a lighter, medium blue color. One set of circles is positioned on the left side, another on the right side, and a third set is centered at the bottom. The circles in each set are of varying diameters, creating a ripple effect. The text '3.2-Apparatus' is centered horizontally and positioned in the upper-middle part of the slide, overlapping the top edges of the circle sets.

## 3.2-Apparatus

## 3.2.1-Apparatus

### Penile plethysmograph

- Standard PPG
- Preftest equipment
- Measure of the penile circumference with a rubber strain-gauge installed around the patient's genitalia
- PPG measurement synchronized with eye-tracking measurements and virtual reality simulator

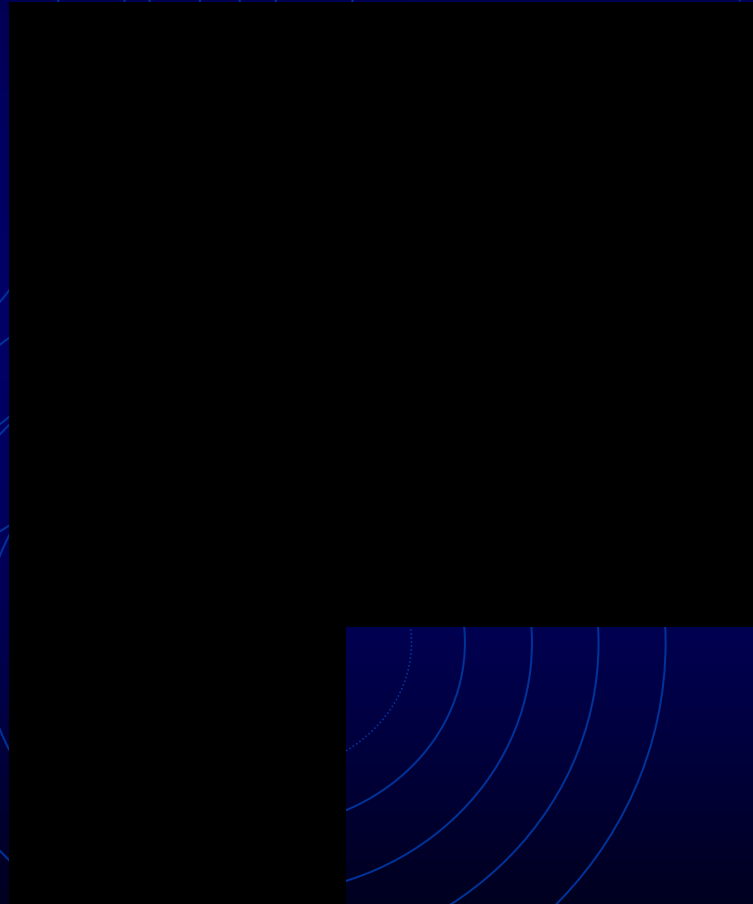




## 3.2.2-Apparatus

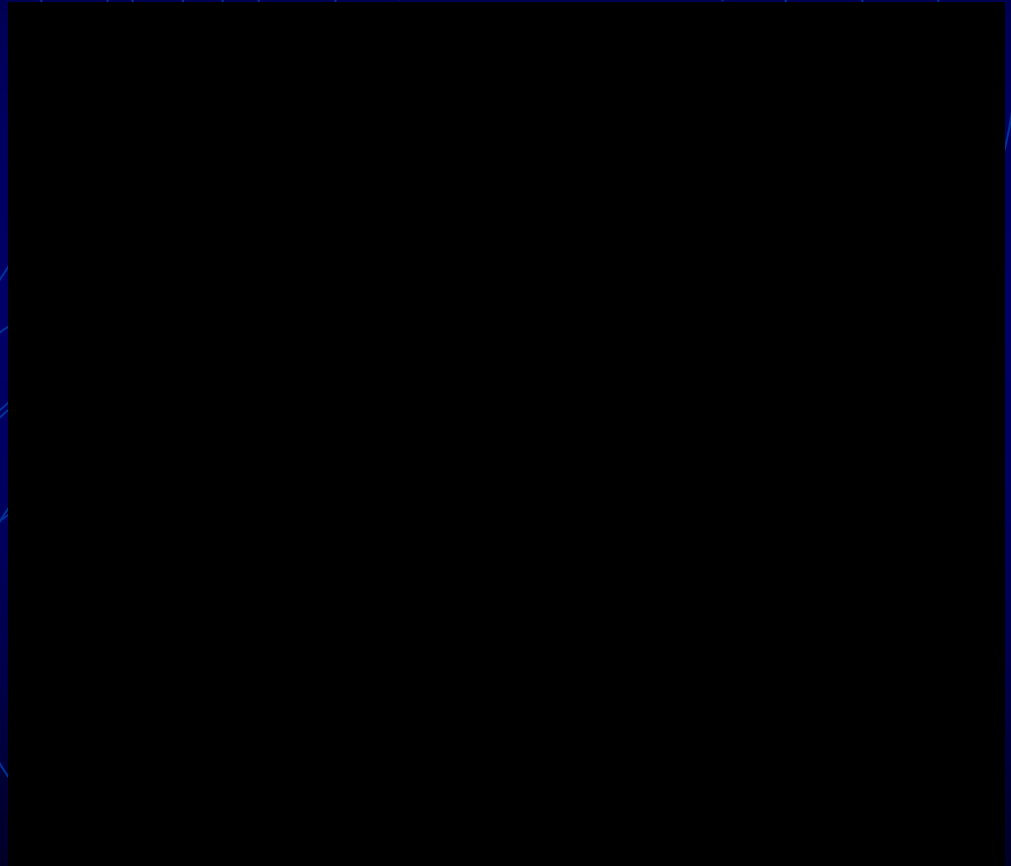
# Eye-tracking: the pan-tilt system

- The ASL Model 504
- Mobile camera driven by head and eye positions
- This system relies on the corneal reflection of an infra-red source that is measured relative to the pupil center location; accuracy is of 1.0 degree
- Stimuli are presented on a computer screen
- Allows the measurement of saccades and fixations patterns on a two dimension plane



## 3.2.4-Tracking eye movements in virtual immersion

- The scene viewed instantaneously is established by the 6 DOF of the HMD
- The point of regard (POR) is determined by the horizontal and vertical components of the eye's saccadic movements
- The crosshair depicts the POR of the assessed individual being in immersion
- This system allows the clinician/researcher to place himself in the vantage perspective of the assessee, when the latter is actually getting access to specific parts of the virtual stimuli
- First hand help to keep control of the perceptual and cognitive contents entertained by the assessee



The background of the slide is a solid dark blue. Overlaid on this background are three sets of concentric circles in a lighter blue color. One set is located in the upper left, another in the upper right, and the third is centered at the bottom. The circles in each set are of varying diameters, creating a ripple effect. The text '3.3-Methodology' is centered horizontally between the two upper sets of circles.

## 3.3-Methodology

### 3.3.1-Subjects

- 5 heterosexual normal subjects
  - Age: 27.8 yrs in average
- 4 paedophile subjects (2 heterosexual, 1 homosexual and 1 bisexual)
  - Patients attending therapy at the forensic programme of the Royal Ottawa Hospital
  - Age 46.5 yrs in average

### 3.3.2-Procedure

- Subjects were seated
- Penile gauge on
- Gaze tracked
- Exposure: 2 minutes 30 seconds with each stimulus
- Instructions: Look carefully at the animation
- Mixed design: independent groups (normals vs paedophiles) with repeated measures on the stimulus factor (neutral avatar, adult female avatar, adult male avatar, child female avatar and child male avatar)



# 4-Results

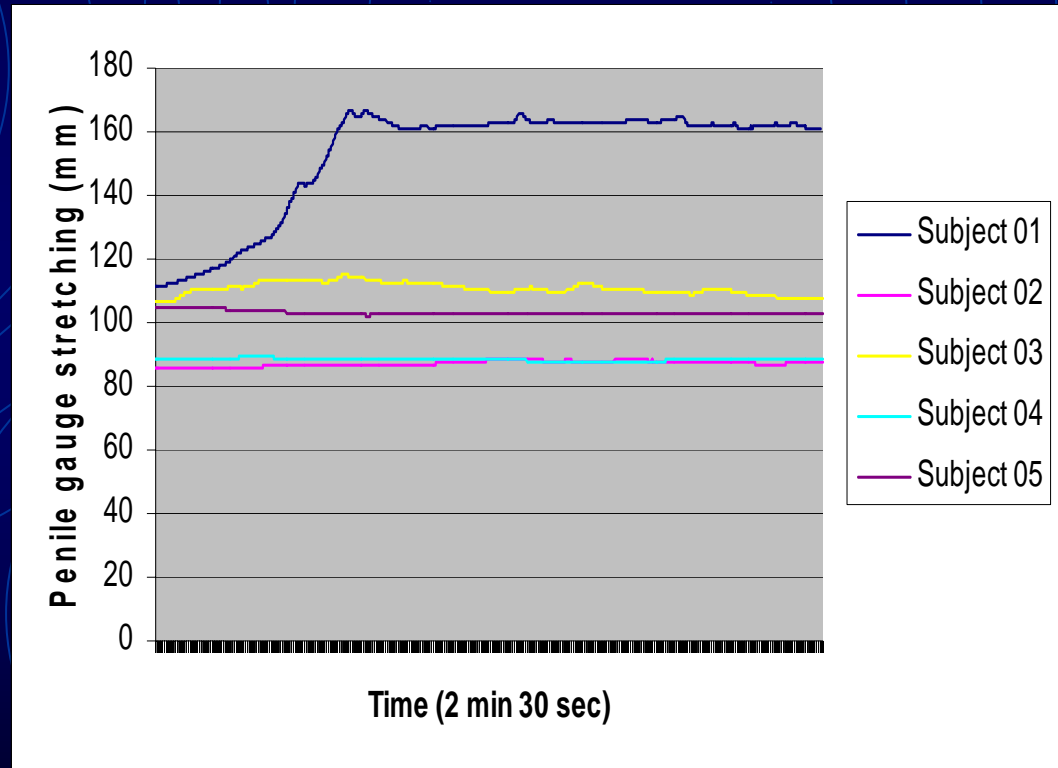
The background of the slide is a dark blue color. It features three sets of concentric circles, each consisting of four rings. The circles are light blue and are arranged in a triangular pattern: one set in the top left, one in the top right, and one centered at the bottom. The text is centered in the upper middle portion of the slide, overlapping the top two sets of circles.

## 4.1-Results: Sexual responses

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### Normal subjects with female adult avatar

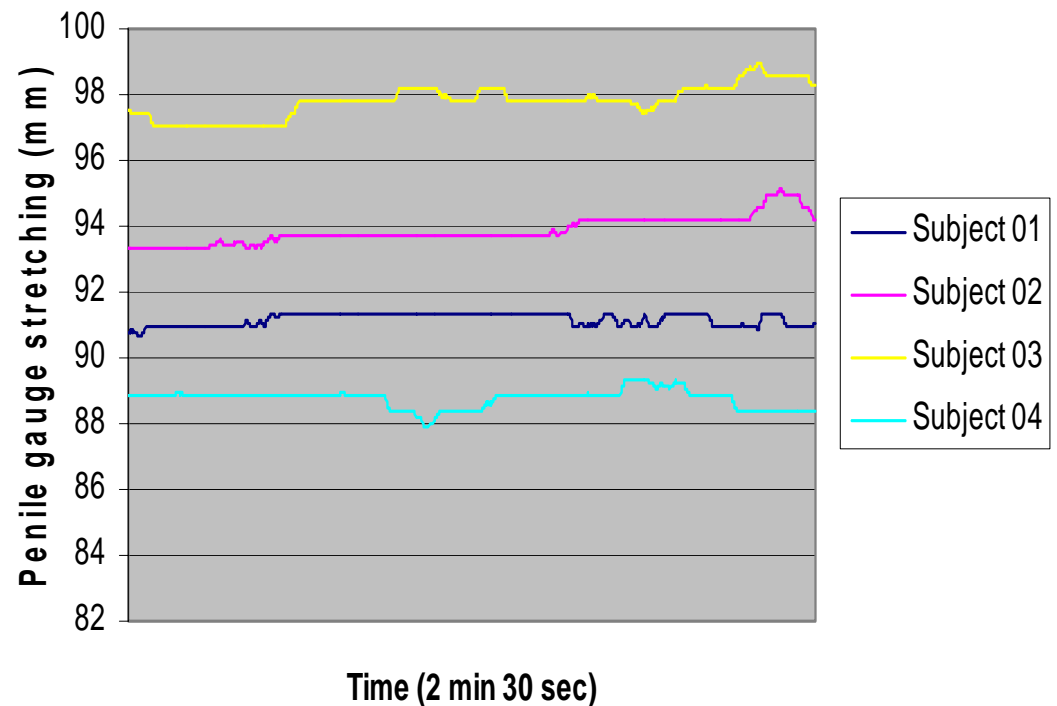
- \* Significant erectile response: increase of more than 2.5 mm in penile circumference
- Subject 01: 55.27 mm \*
- Subject 02: 2.85 mm \*
- Subject 03: 8.01 mm \*
- Subject 04: 0.99 mm
- Subject 05: 0.36 mm





## 4.1.2-Results: Sexual responses Paedophile subjects with adult avatars

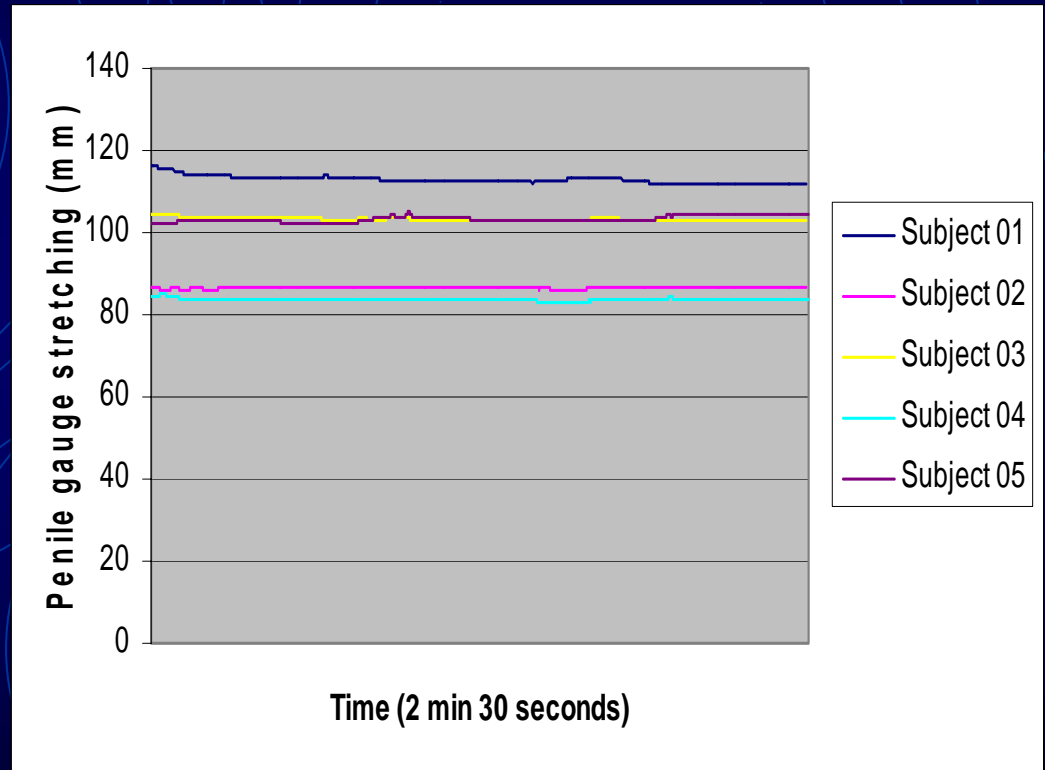
- \* Significant erectile response: increase of more than 2.5 mm in penile circumference
- Subject 01: 0.62 mm
- Subject 02: 1.78 mm
- Subject 03: 0.30mm
- Subject 04: 0.45mm
  - Homosexual subject: results obtained from exposure with the male adult avatar



## 4.1.3-Results: Sexual responses

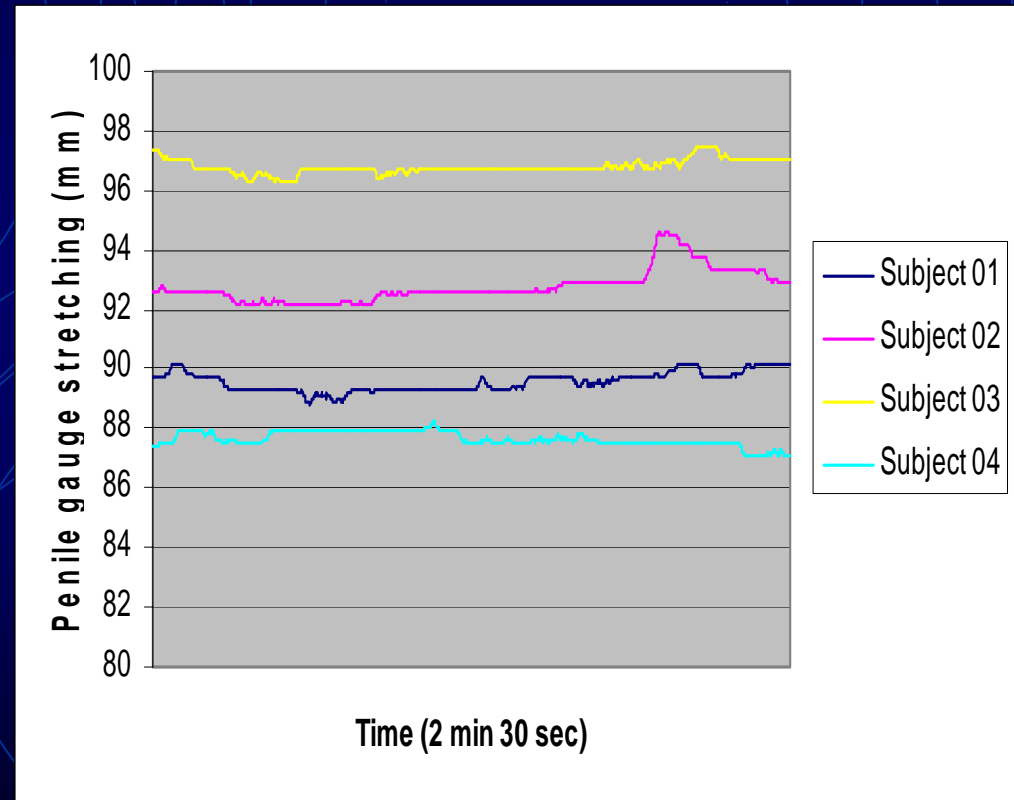
### Normal subjects with female child avatar

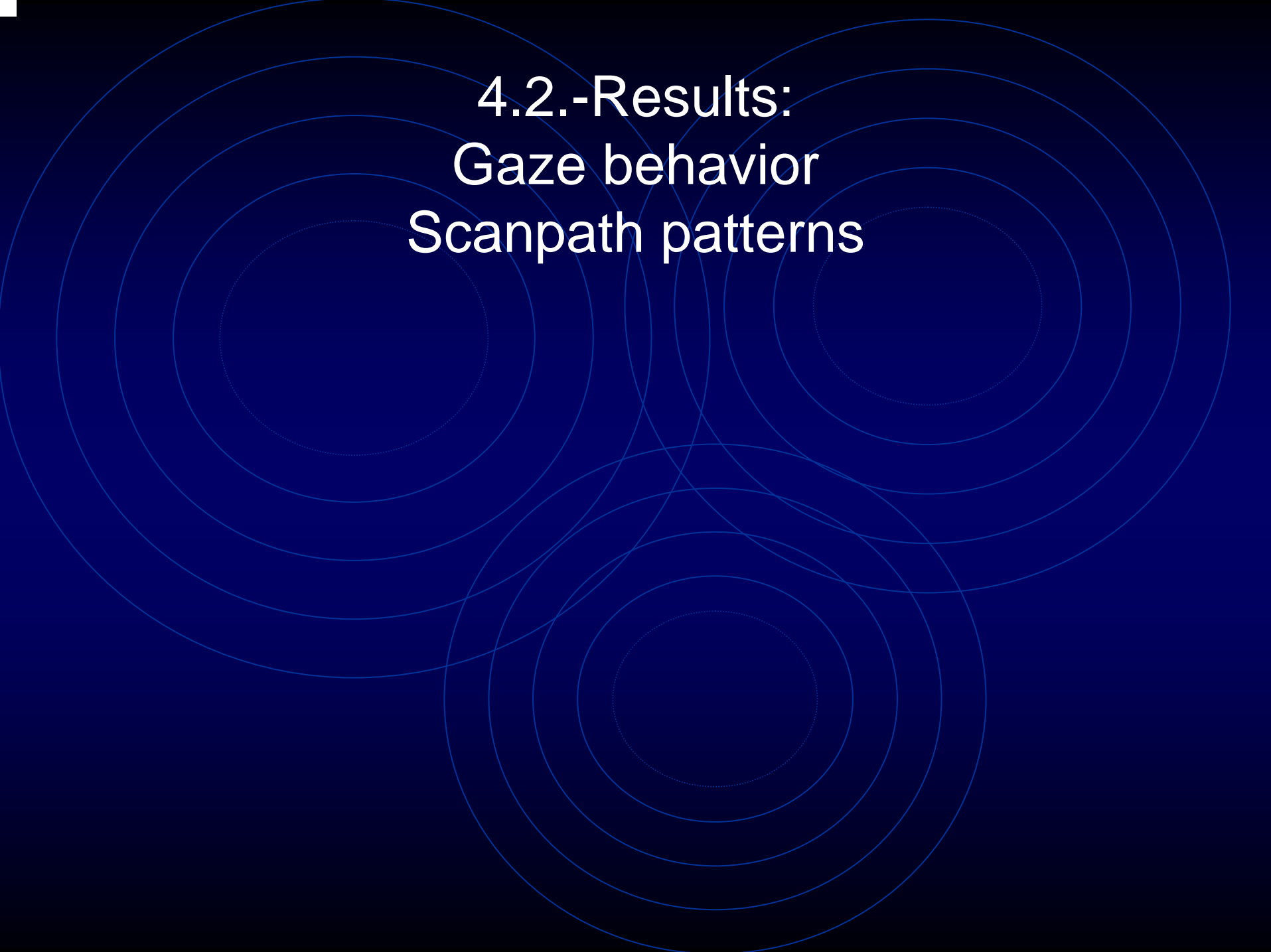
- \* Significant erectile response: increase of more than 2.5 mm in penile circumference
- Subject 01: 0.0 mm
- Subject 02: 1.3 mm
- Subject 03: 0.0 mm
- Subject 04: 0.52 mm
- Subject 05: 2.44 mm



## 4.1.4-Results: Sexual responses Paedophile subjects with female child avatar

- \* Significant erectile response: increase of more than 2.5 mm in penile circumference
- Subject 01: 0.40 mm
- Subject 02: 2.04 mm
- Subject 03: 0.04 mm
- Subject 04: 0.86 mm



The background of the slide features three large, overlapping circles. Each circle contains several concentric rings, creating a target-like or ripple effect. The circles are positioned such that they overlap in the center of the slide, with one circle on the left, one on the right, and one at the bottom center.

## 4.2.-Results:

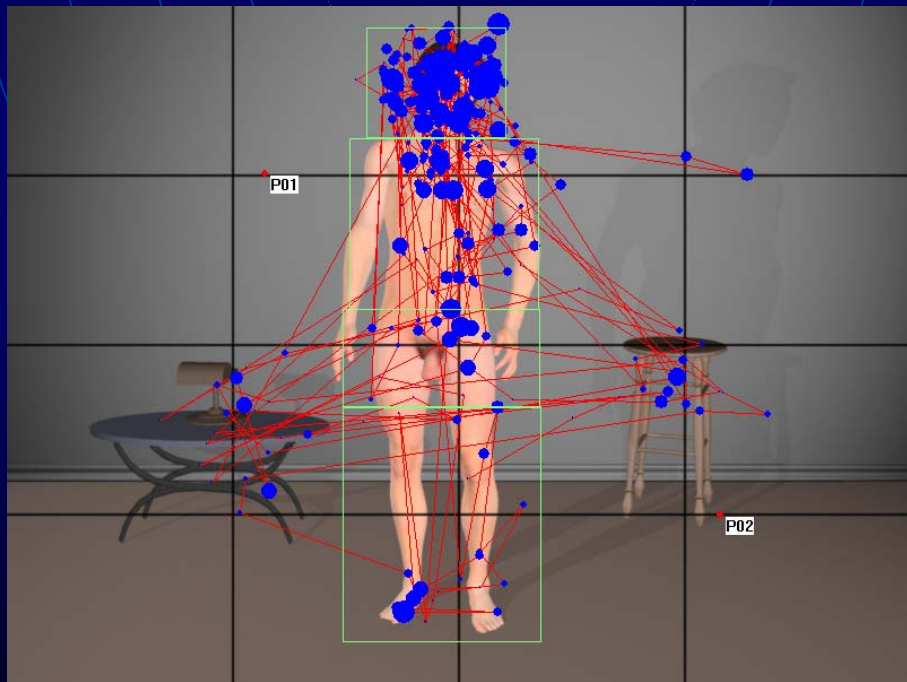
### Gaze behavior

### Scanpath patterns

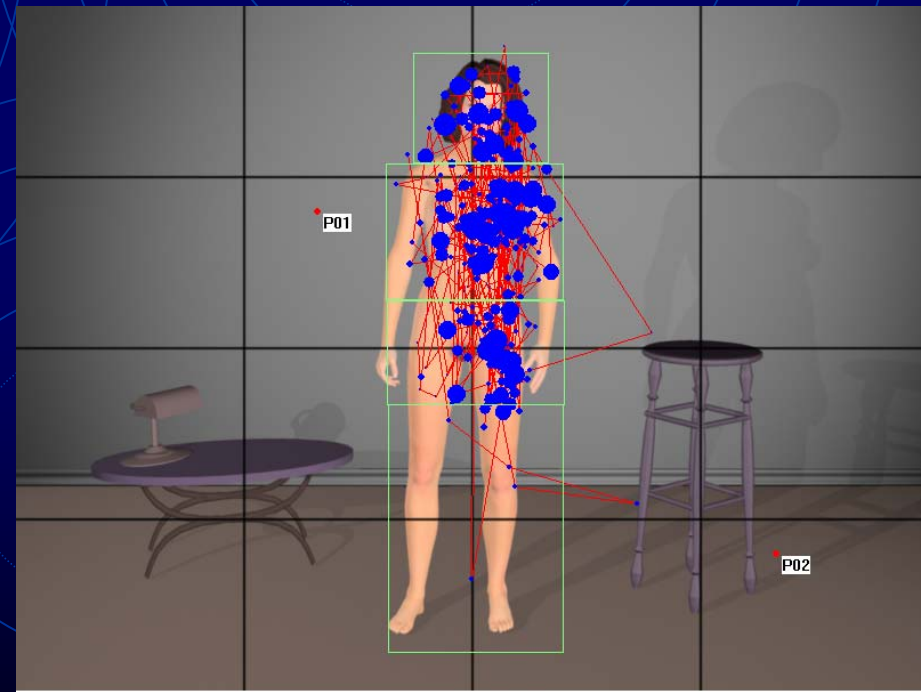
# 4.2.1 – Normal heterosexual subject scanpaths: sexual preferences in terms of gender

(blue dots: fixations; red lines: saccades)

Male adult avatar

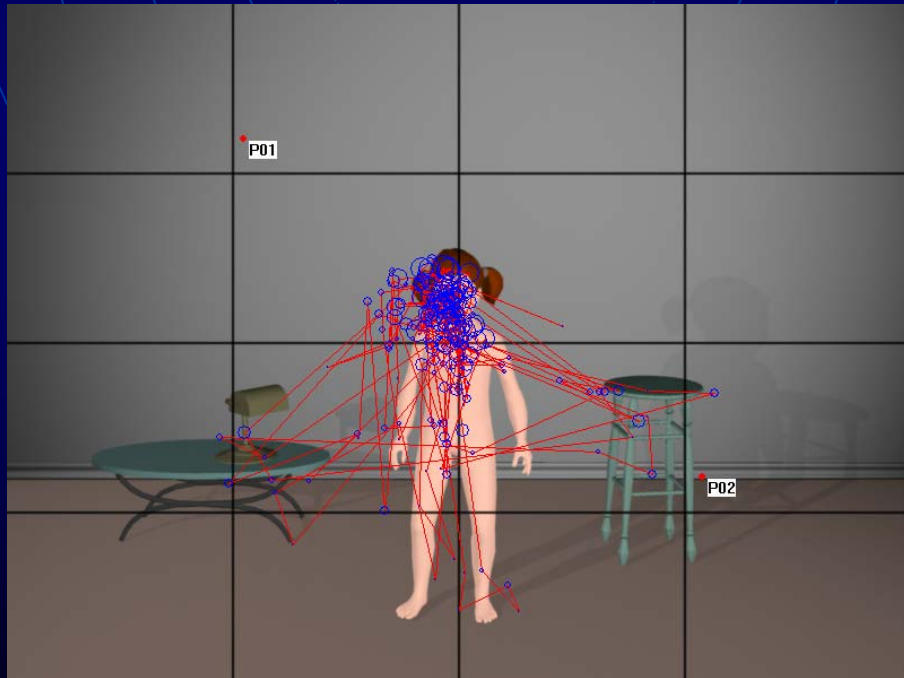


Female adult avatar

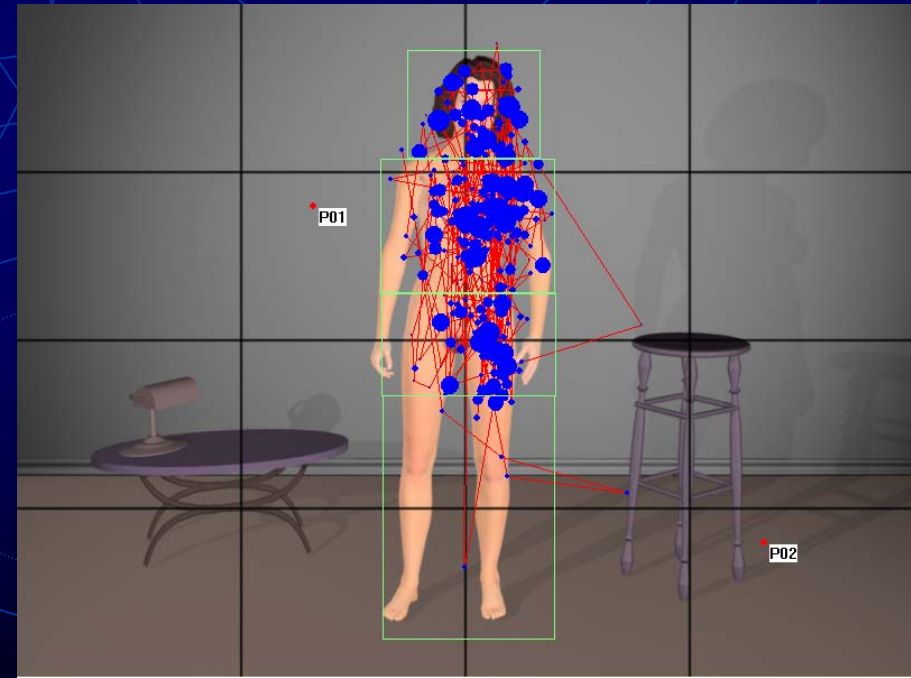


## 4.2.2 - Normal heterosexual subject scanpaths: sexual preferences in terms of age

Female child avatar



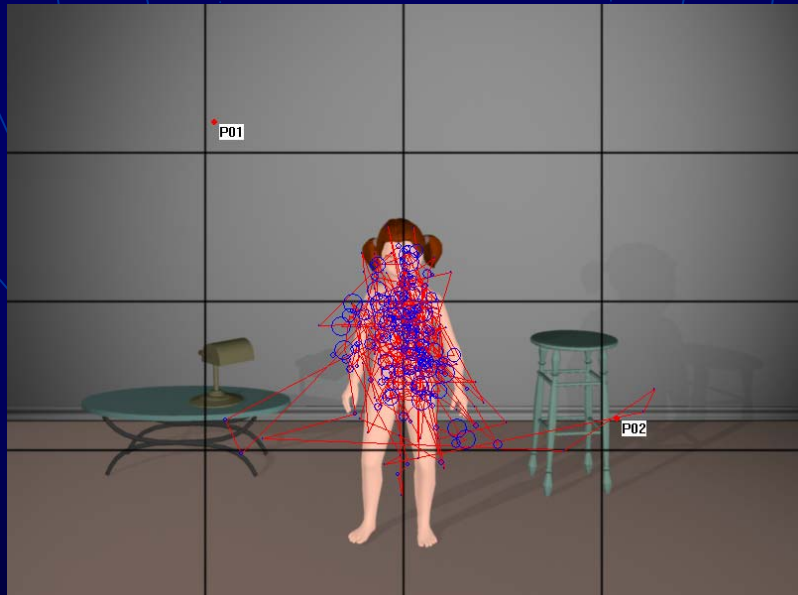
Female adult avatar



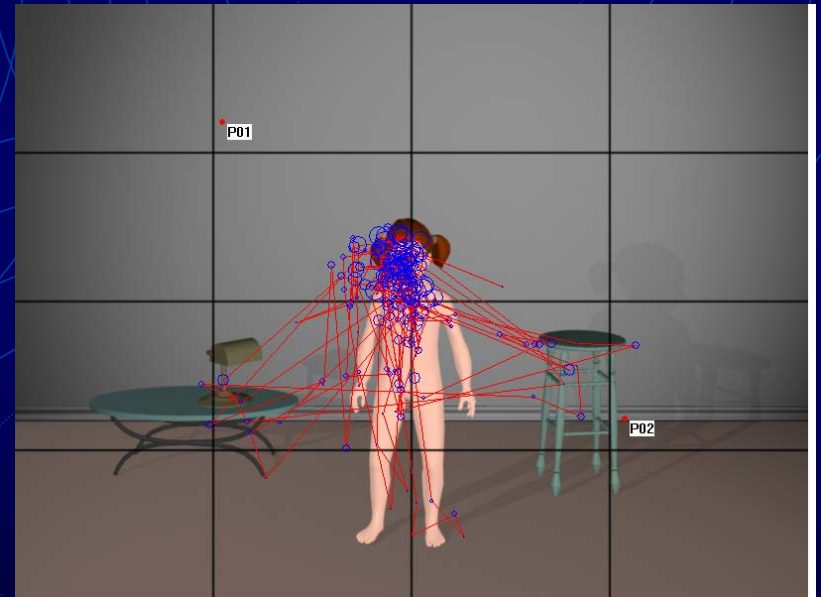
## 4.2.3 – Paedophile vs normal

Female child avatar

**Paedophile**



**Normal**

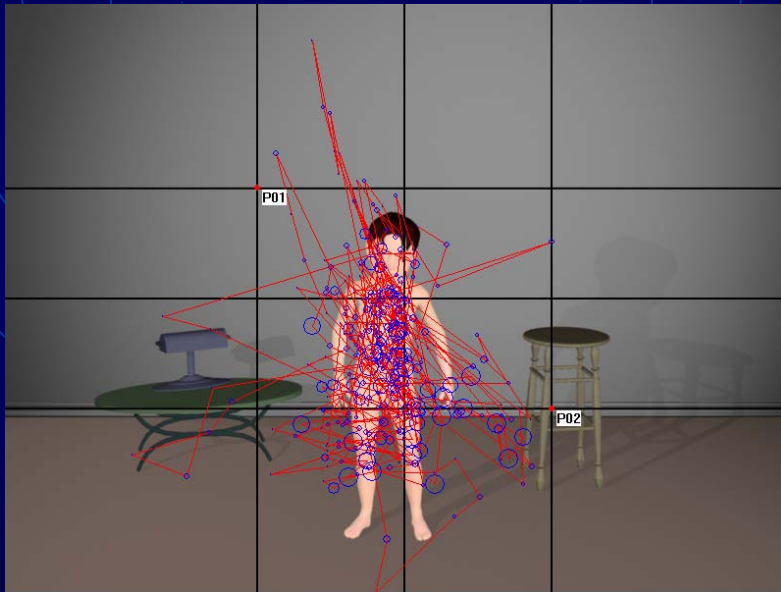




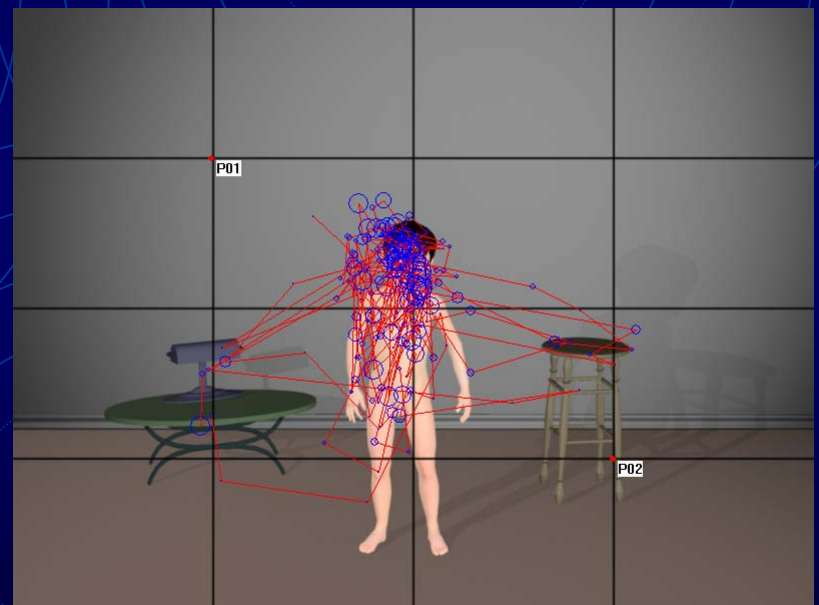
## 4.2.4 – Paedophile vs normal

Male child avatar

**Paedophile**



**Normal**

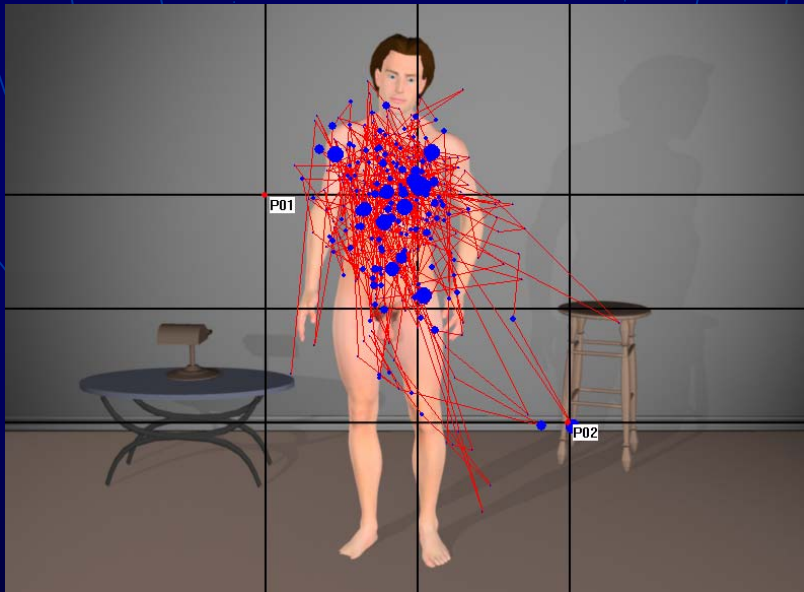




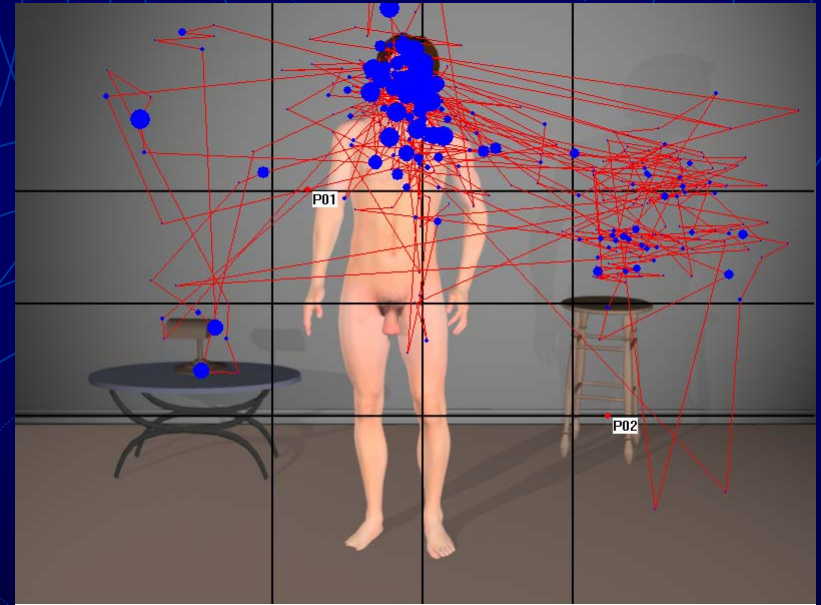
## 4.2.5–Homosexual (paedophile) vs heterosexual (normal)

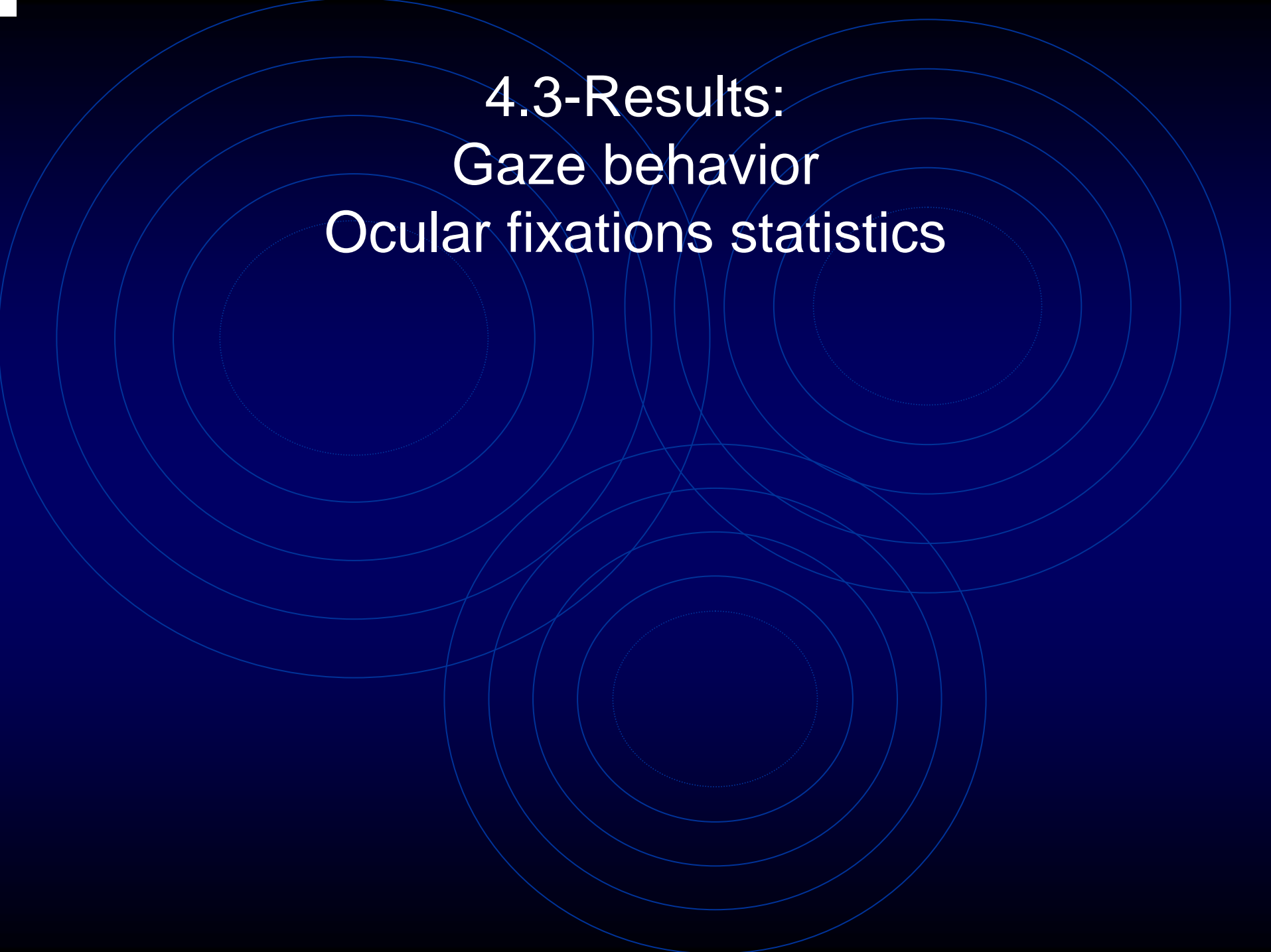
Male adult avatar

**Homosexual**



**Heterosexual**



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## 4.3-Results:

### Gaze behavior

### Ocular fixations statistics

## 4.3.1-Ocular fixations statistics: ratios

- In order to control for individual differences in terms of oculomotor behavior, ratios of fixations number were computed
- Ratios: number of ocular fixations in any condition divided by the number of ocular fixations in the sexually neutral condition
- Examples:
  1. 200 fixations with the female adult avatar and 250 with the sexually neutral avatar:  $200/250 = 0.8$
  2. 160 fixations with the female child avatar and 250 with the sexually neutral avatar:  $160/250 = 0.64$

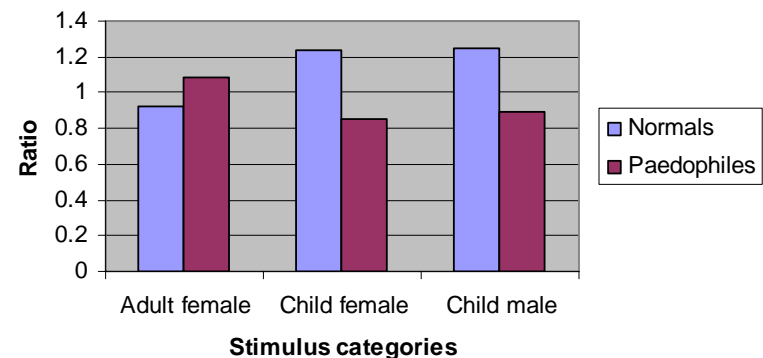
## 4.3.1-Ocular fixations statistics: ratios (ctnd)

- **Paedophiles** presented significantly fewer ocular fixations than normals when presented with the female child avatar ( $E(1,5)=12.694$ ,  $p=0.016$ ) as well as with the male child avatar ( $E(1,5)=12.321$ ,  $p=0.017$ ); fixations duration tended to be longer (n.s.)
- The converse was observed with the female adult avatar, i.e. **normals** presented significantly fewer ocular fixations ( $E(1,5)=9.382$ ,  $p=0.021$ ); fixations duration tended to be longer (n.s.)
- Distinct gaze patterns between paedophiles and normals

Pairwise Comparisons

Dependent Variable			Mean Difference (I-J)	Sig.
Fixations ratios	(I)	(J)		
Fem. child / Neutral	Normals	Paedophiles	.382	.016
Male child / Neutral	Normals	Paedophiles	.361	.017
Fem. adult / Neutral	Normals	Paedophiles	-.159	.028

Number of fixations ratio  
(sexual stimulus / neutral stimulus)



## 5-Conclusion

- This first attempt to assess sexual preference among paraphiliacs using virtual reality (VR) and eye-trackers brings promising results for forensic psychology
- In itself, on a purely technical ground, combining VR and eye-trackers ensure a better internal validity to PPG while getting round with ethical problems relating to using real child models to prompt sexual arousal

## 5-Conclusion (ctnd)

- Develop more realistic sexual avatars and sexual contexts to prompt sexual arousal in patients
- Deepen the meaning of gaze behavior as a diagnostic index of sexual preference
  - Try to bring out patterns of fixations and saccades that would be distinctive of sexual preferences among paraphiliacs and normals
- Test with more patients

# Acknowledgements

- Canadian Foundation for Innovation
- Simulations and Advanced Gaming Environments for Learning project (funded by the Social Sciences and Humanities Research Council of Canada - SSHRC)
- *Université du Québec en Outaouais*
- *Institut Philippe Pinel de Montréal*
- Specific programming for this project was done by Christian Villemare, computer scientists