

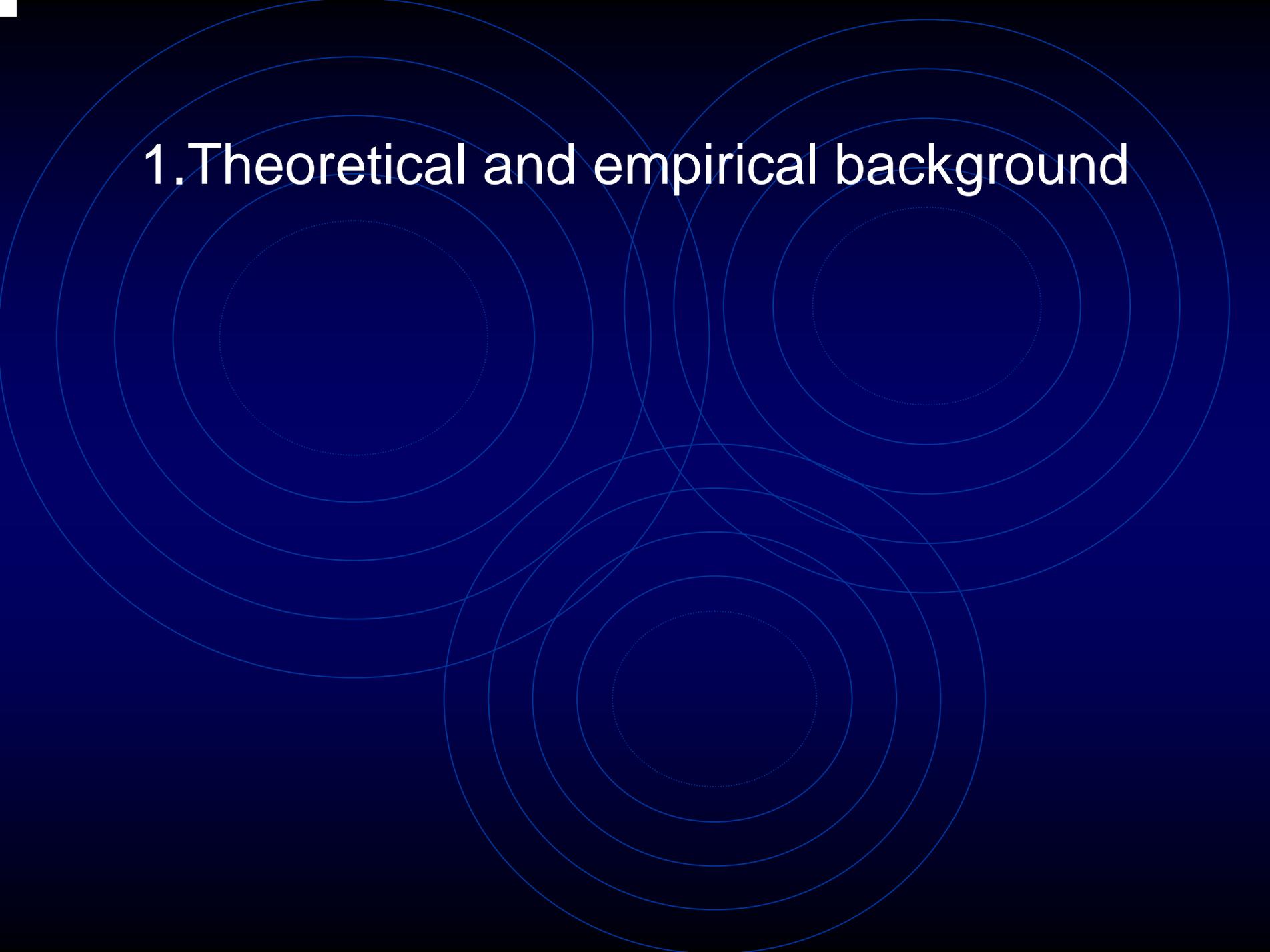
THE RECORDING OF OBSERVATIONAL BEHAVIORS IN VIRTUAL IMMERSION: A NEW RESEARCH AND CLINICAL TOOL TO ADDRESS THE PROBLEM OF SEXUAL PREFERENCES WITH PARAPHILIACS

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1. Theoretical and empirical background

The background features three sets of concentric circles in a light blue color, arranged in a triangular pattern. Each set consists of three concentric circles of increasing size. The circles are semi-transparent and overlap with each other, creating a complex geometric pattern. The text '1. Theoretical and empirical background' is centered at the top in a white, sans-serif font.

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

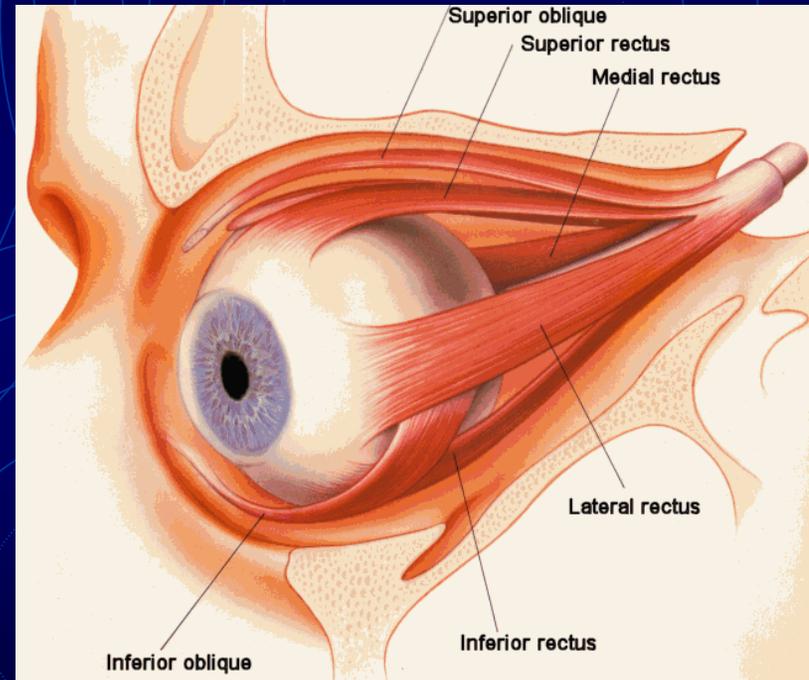
1.3.1-Eye movements: probing attentional content

• **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)

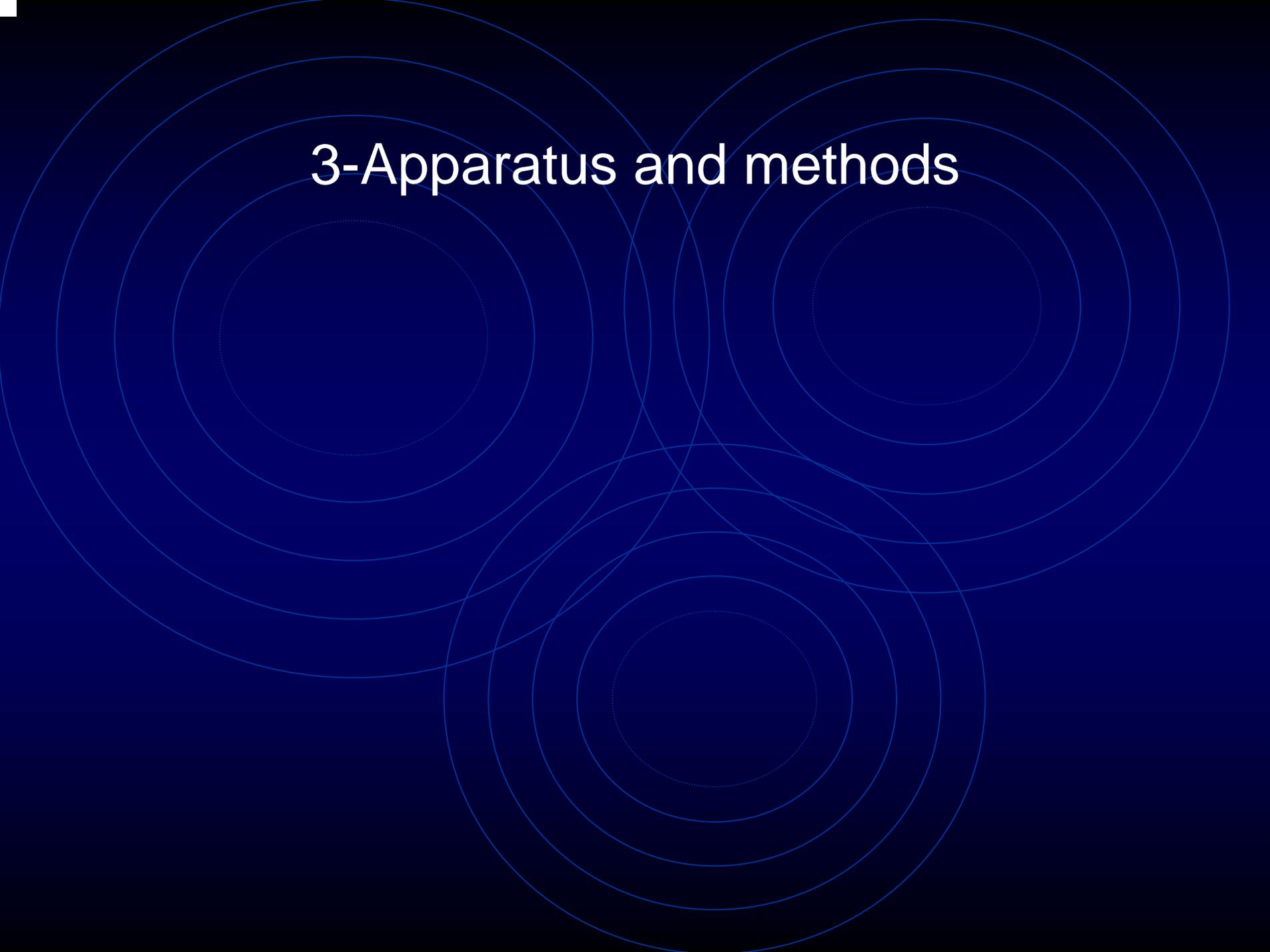
• **Fixation:**

- 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

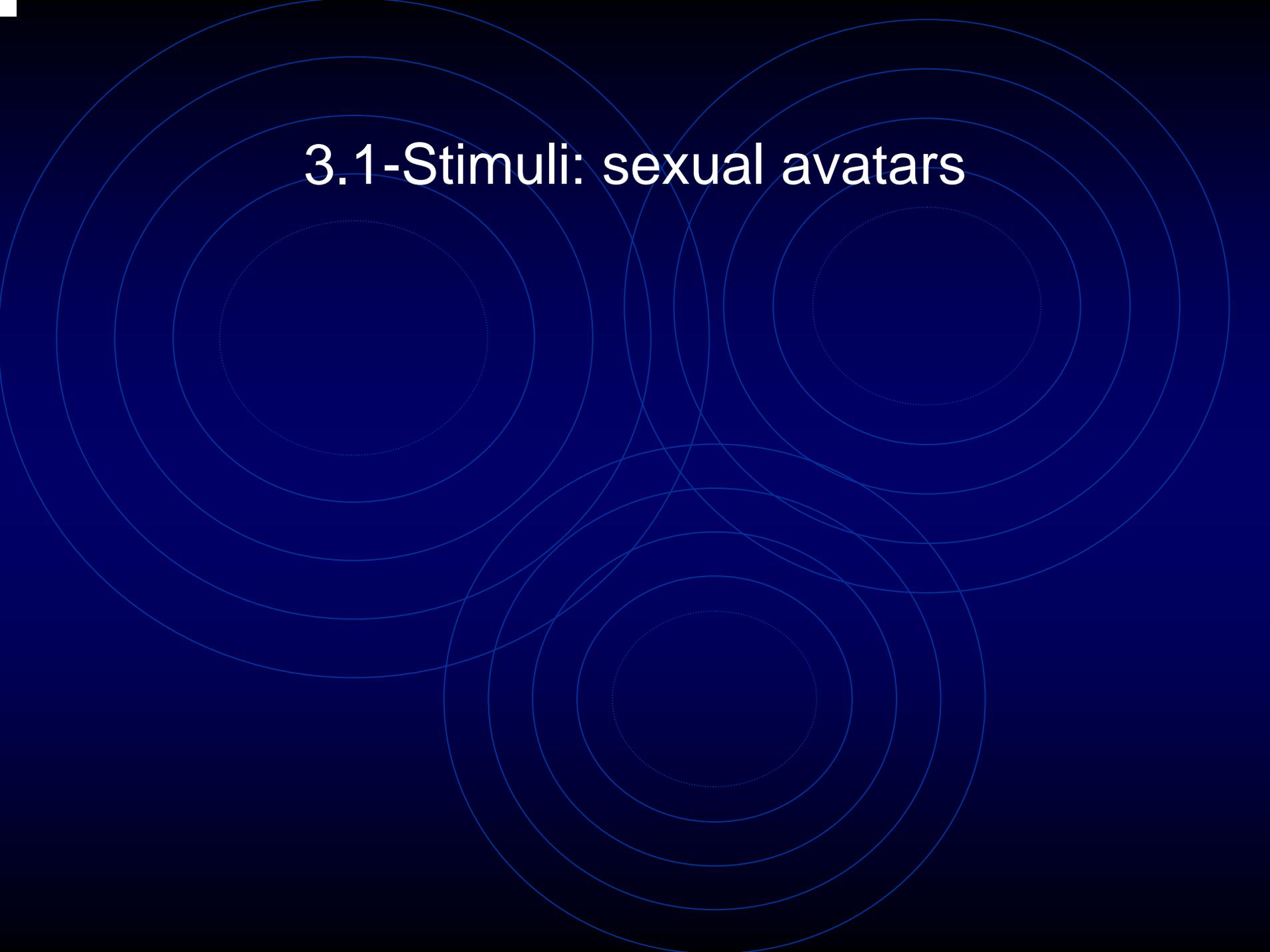


<http://www.sheinman.com/Aanatomy13.htm>

3-Apparatus and methods

The background features three large, overlapping circles arranged in a triangular pattern. Each of these large circles contains a smaller, concentric inner circle. The circles are rendered in a light blue color against a dark blue background.

3.1-Stimuli: sexual avatars

The background of the slide features three large, overlapping circles. Each circle contains a smaller, concentric inner circle, creating a target-like or ripple effect. The circles are positioned in a triangular arrangement, with one at the top left, one at the top right, and one centered at the bottom. The overall aesthetic is clean and modern, using a dark blue color palette.

3.1.1-Adult female avatar



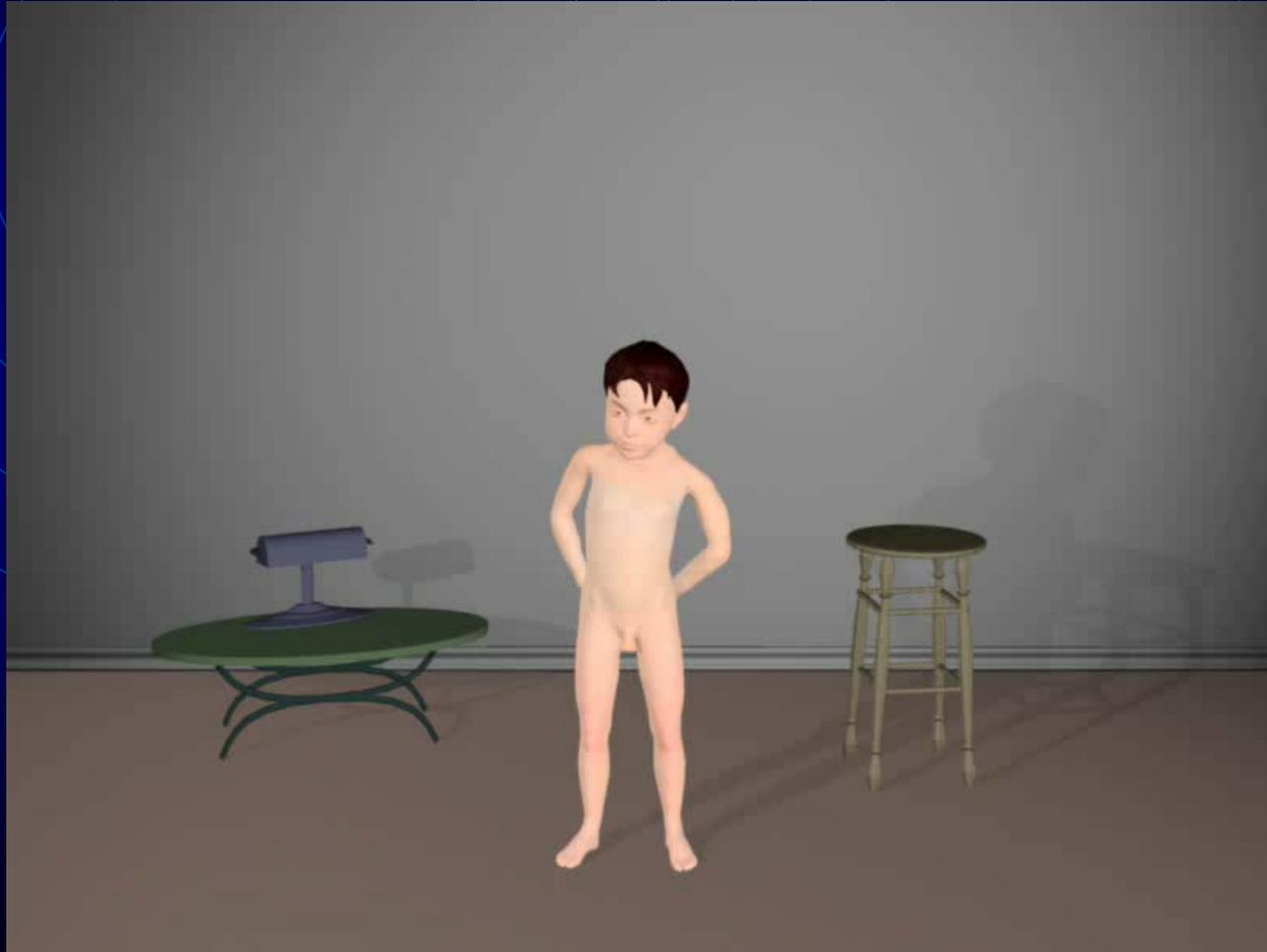
3.1.2-Adult male avatar



3.1.3- Child female avatar



3.1.4- Child male avatar



3.1.5- Sexually neutral avatar



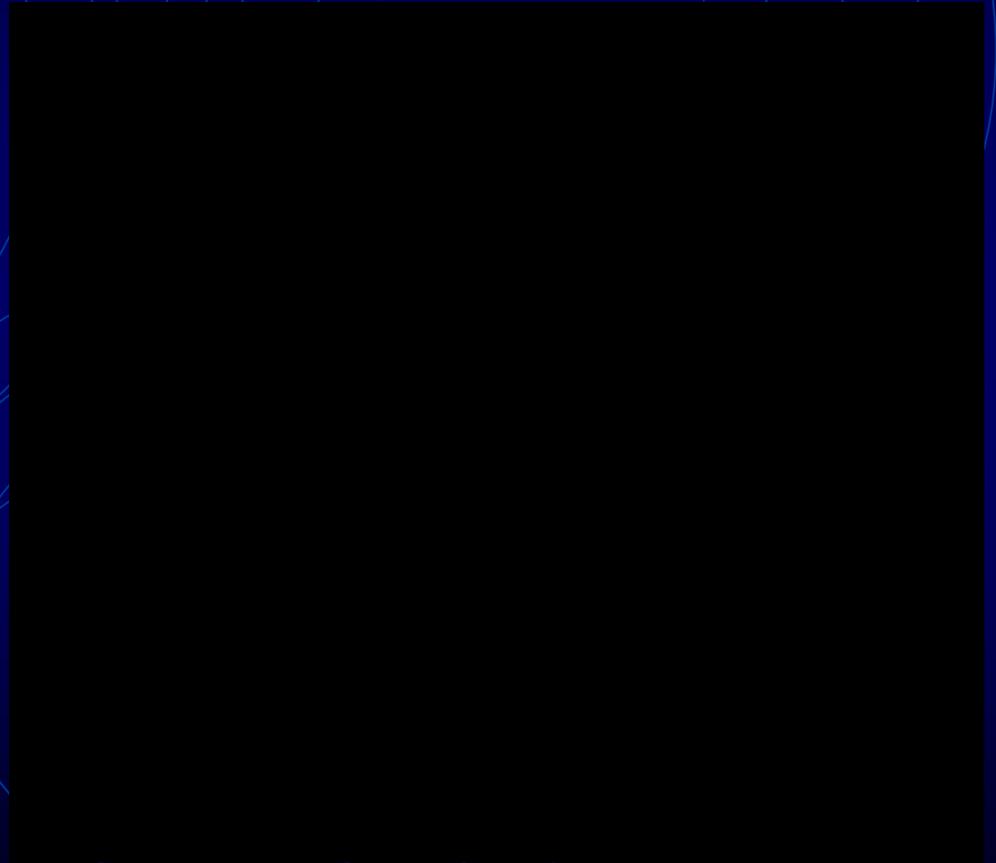
3.2-Apparatus

The background of the slide features three large, overlapping circles arranged in a triangular pattern. Each of these large circles contains a smaller, concentric inner circle. The circles are rendered in a light blue color against a dark blue background. The text '3.2-Apparatus' is centered in the upper portion of the slide, overlapping the top two large circles.

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

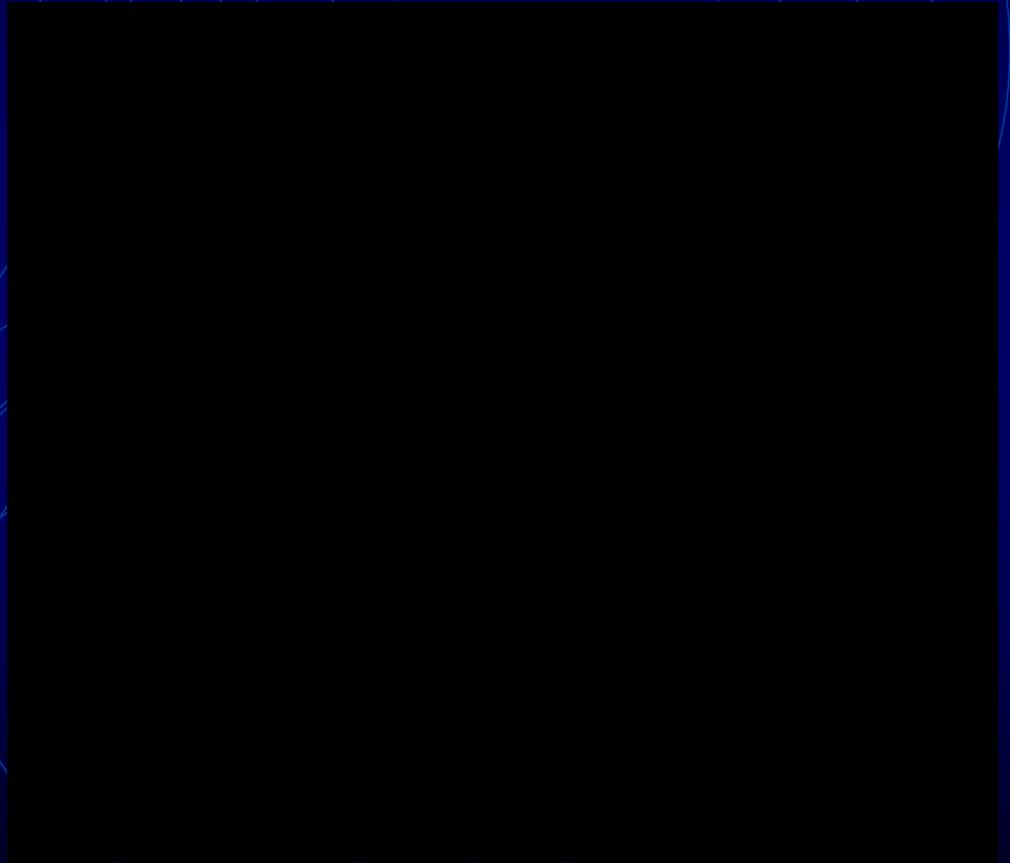
Eye-tracking: the pan-tilt system

- 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

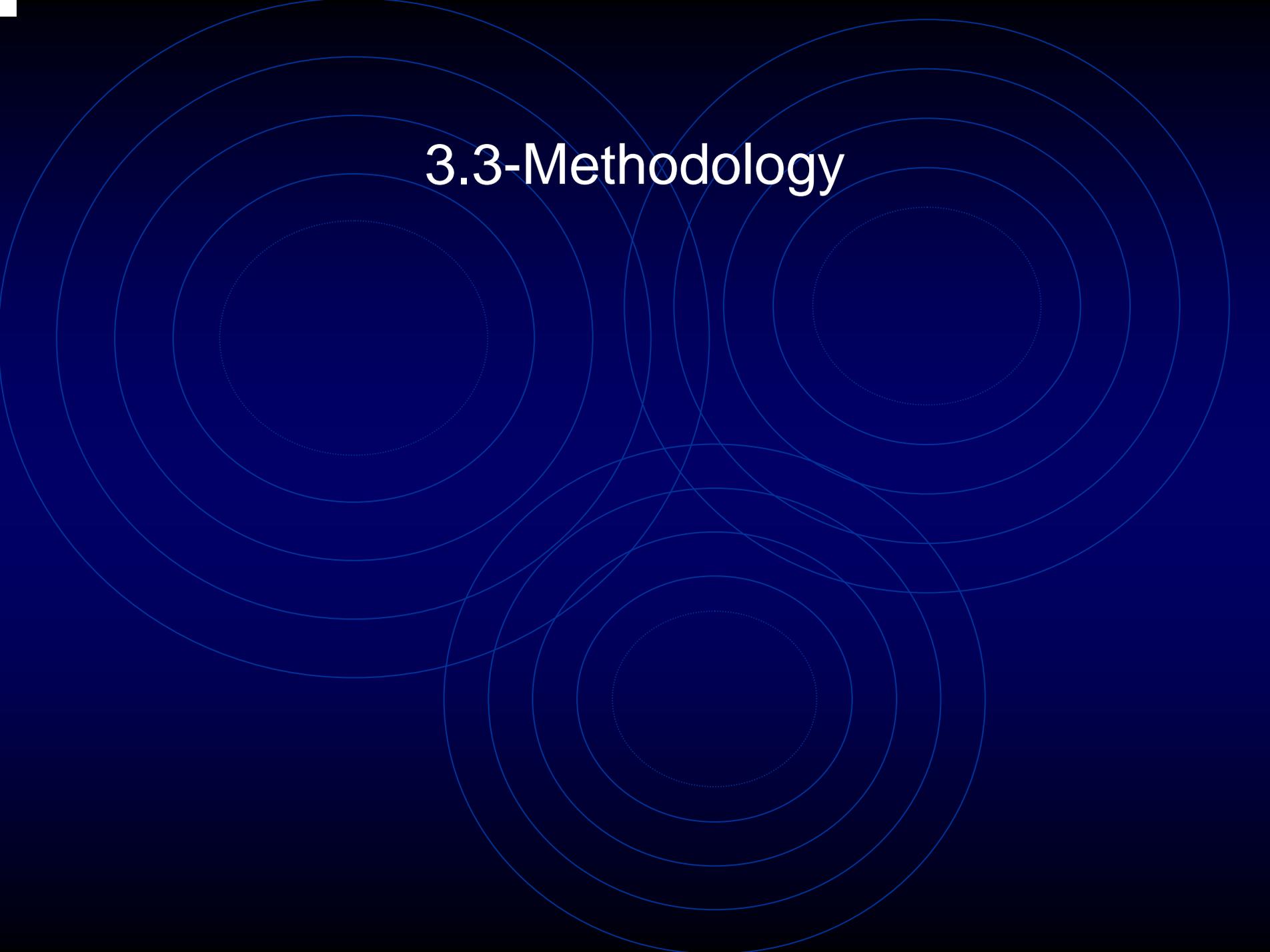


3.2.4-Tracking eye movements in virtual immersion

- 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



3.3-Methodology

The background features three large, overlapping circles in a light blue color. Each of these circles contains a smaller, concentric circle with a dotted border, also in light blue. The circles overlap in the center of the slide, creating a complex geometric pattern.

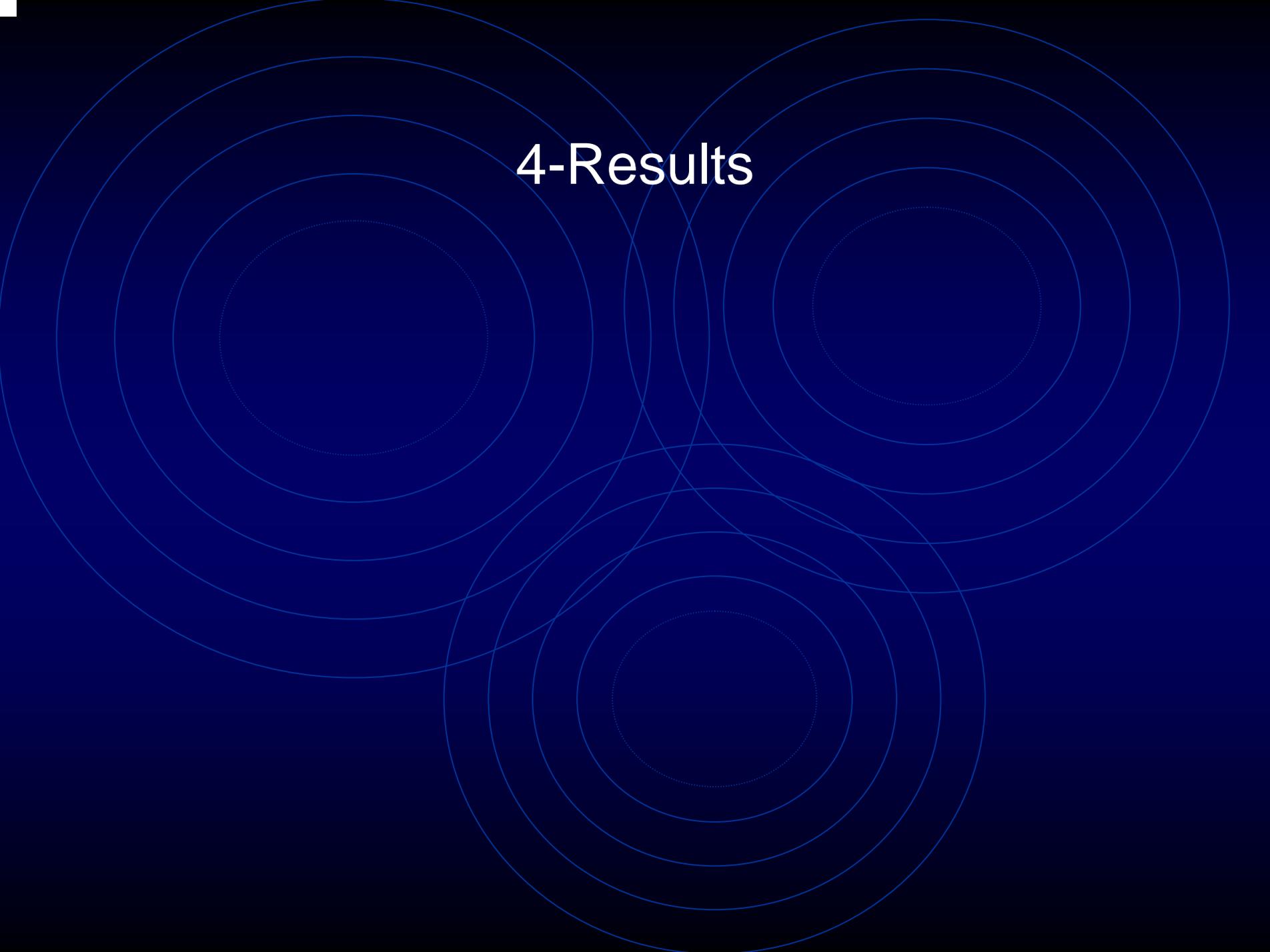
3.3.1-Subjects

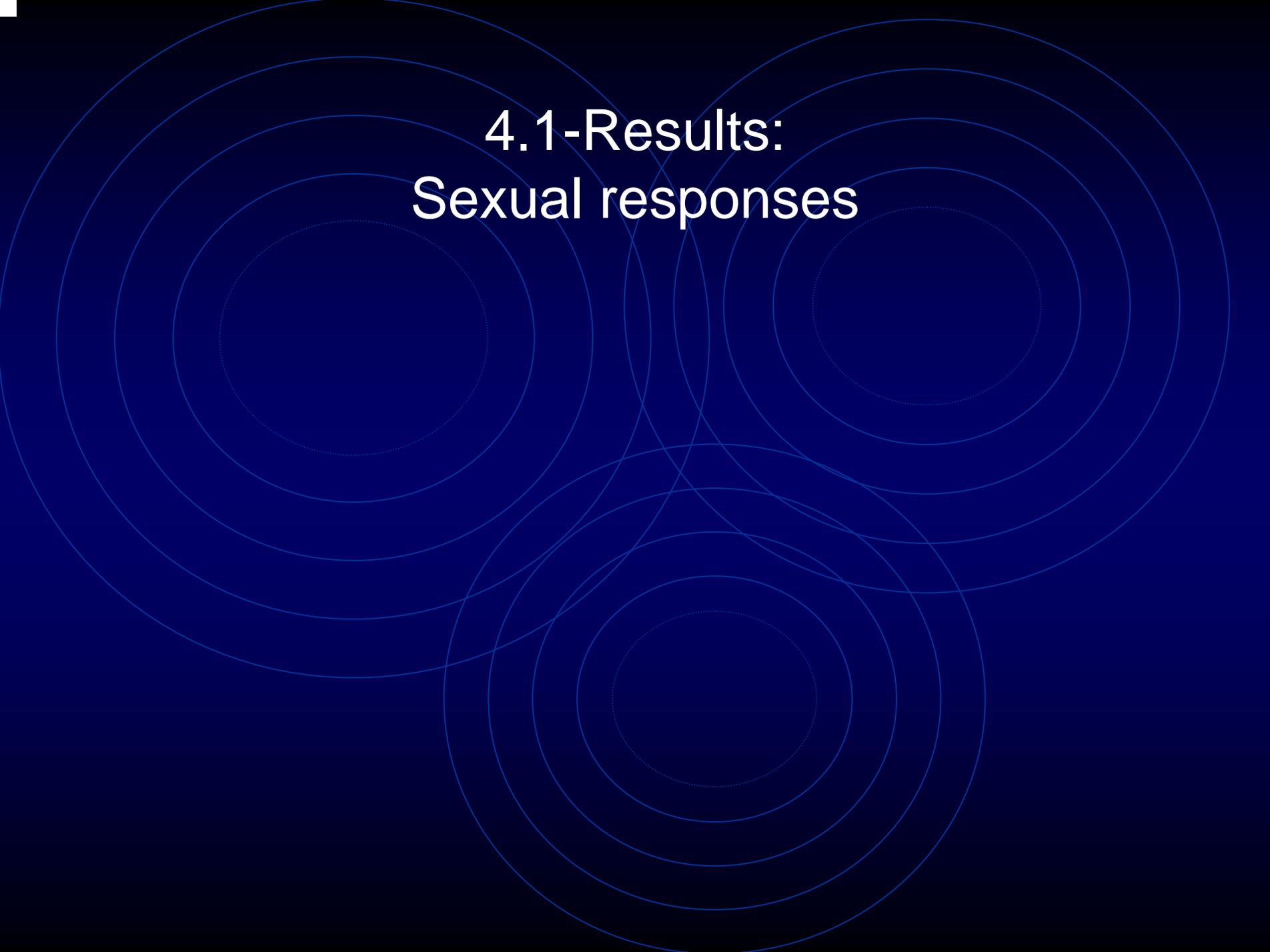
- 5 heterosexual normal subjects
 - Age: 27.8 yrs in average
- 4 paedophile subjects (2 heterosexual, 1 homosexual and 1 bisexual)
 - Patients attending therapy at the forensic programme of the Royal Ottawa Hospital
 - Age 46.5 yrs in average

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 features three large, overlapping circles. Each circle contains a smaller, concentric inner circle. The circles are arranged in a triangular pattern, with one at the top left, one at the top right, and one at the bottom center. The text '4-Results' is centered horizontally between the two top circles.

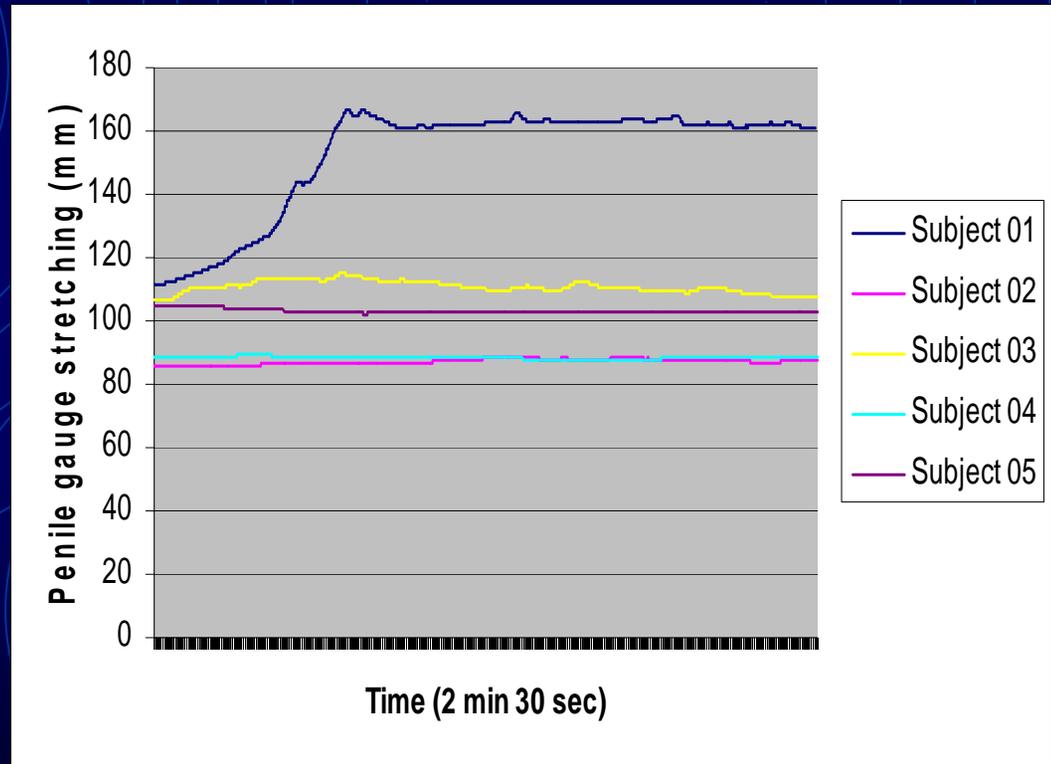
The background features three large, overlapping circles. Each circle contains several concentric rings, creating a target-like or ripple effect. The circles are positioned in a triangular arrangement, with one at the top left, one at the top right, and one at the bottom center. The overall aesthetic is clean and modern, using a dark blue color palette.

4.1-Results: Sexual responses

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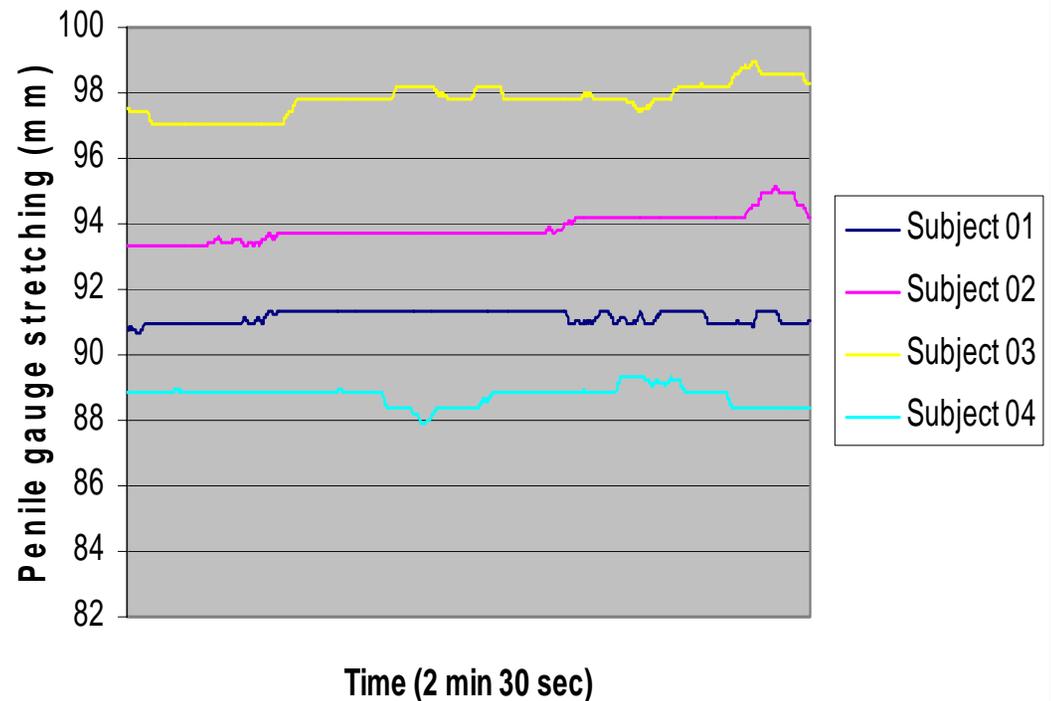
Normal subjects with female adult avatar

- * 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



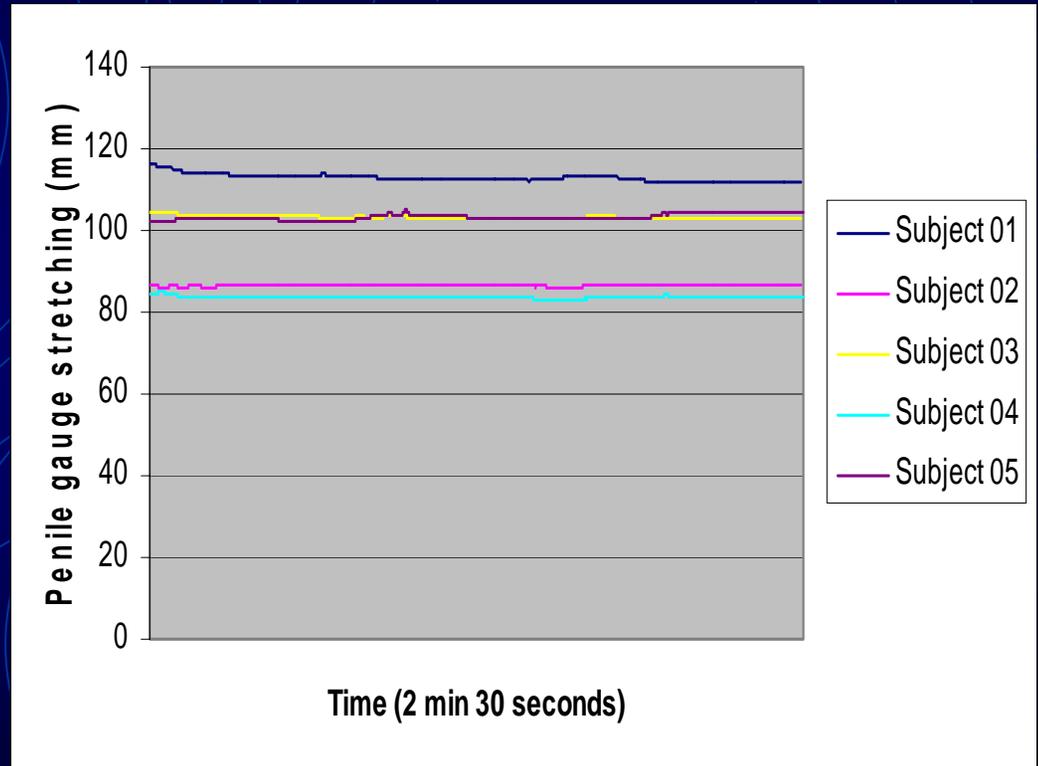
4.1.2-Results: Sexual responses Paedophile subjects with adult avatars

- * 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



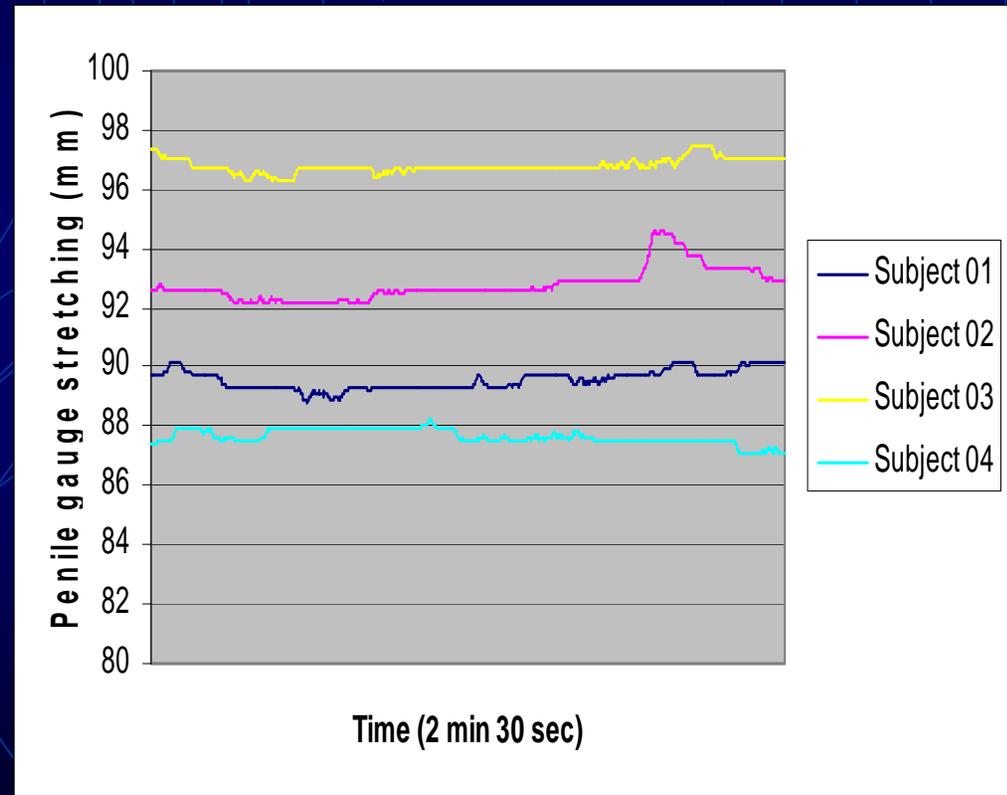
4.1.3-Results: Sexual responses Normal subjects with female child avatar

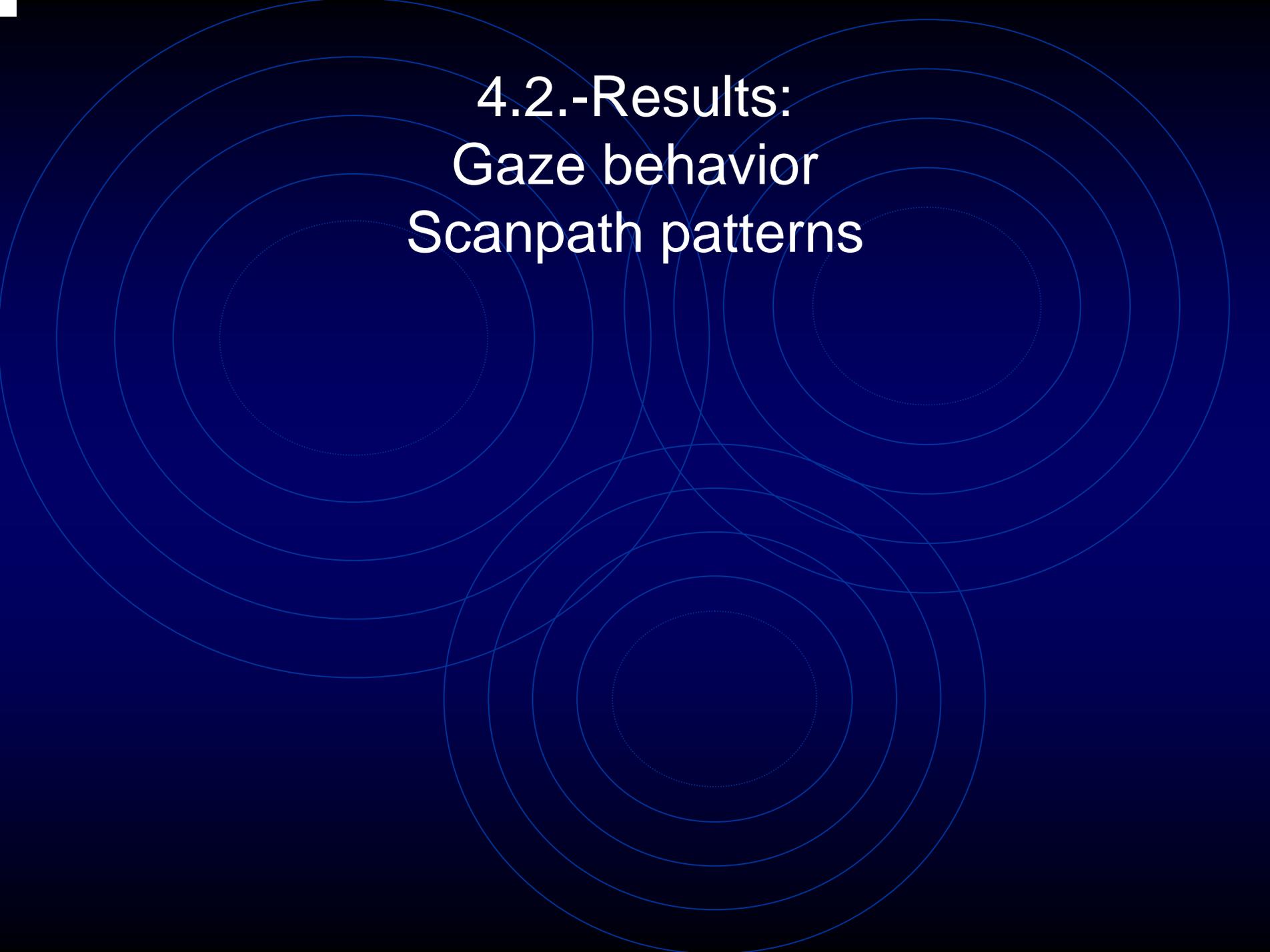
- * Significant erectile response: increase of more than 2.5 mm in penile circumference
- Subject 01: 0.0 mm
- Subject 02: 1.3 mm
- Subject 03: 0.0 mm
- Subject 04: 0.52 mm
- Subject 05: 2.44 mm



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





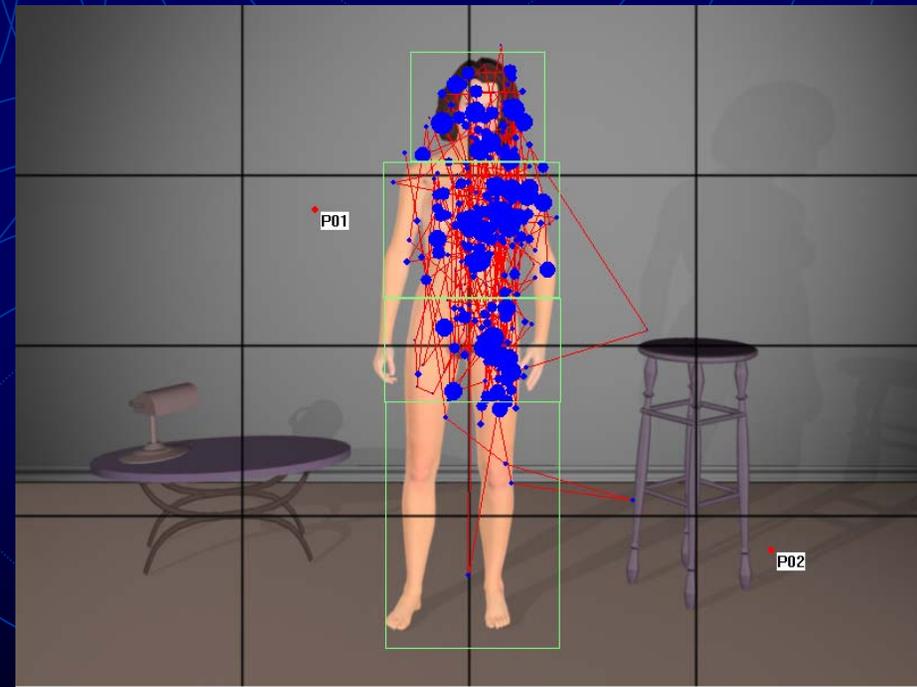
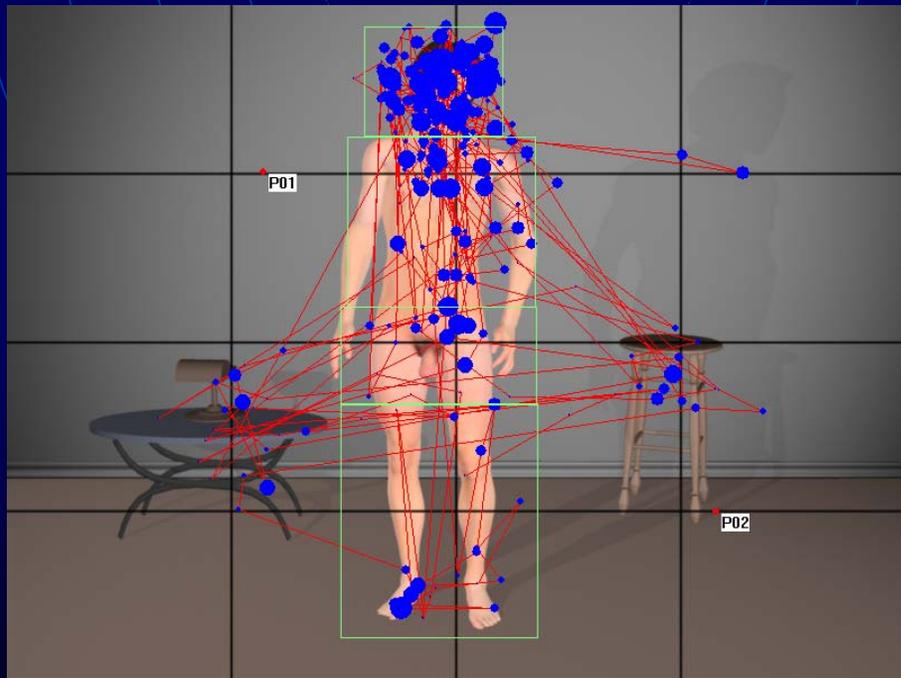
4.2.-Results: Gaze behavior Scanpath patterns

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

(blue dots: fixations; red lines: saccades)

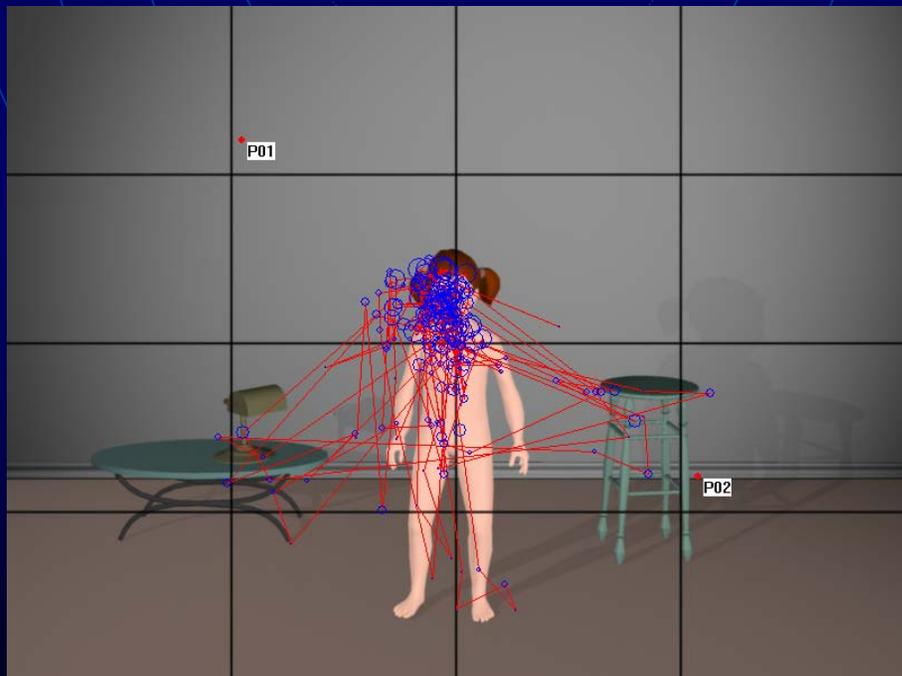
Male adult avatar

Female adult avatar

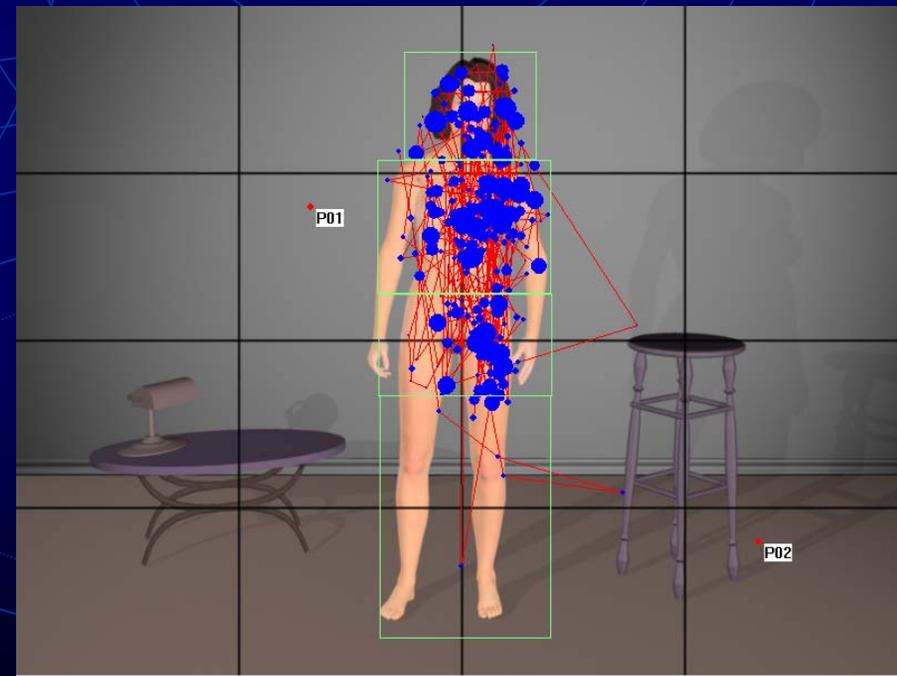


4.2.2 - Normal heterosexual subject scanpaths: sexual preferences in terms of age

Female child avatar



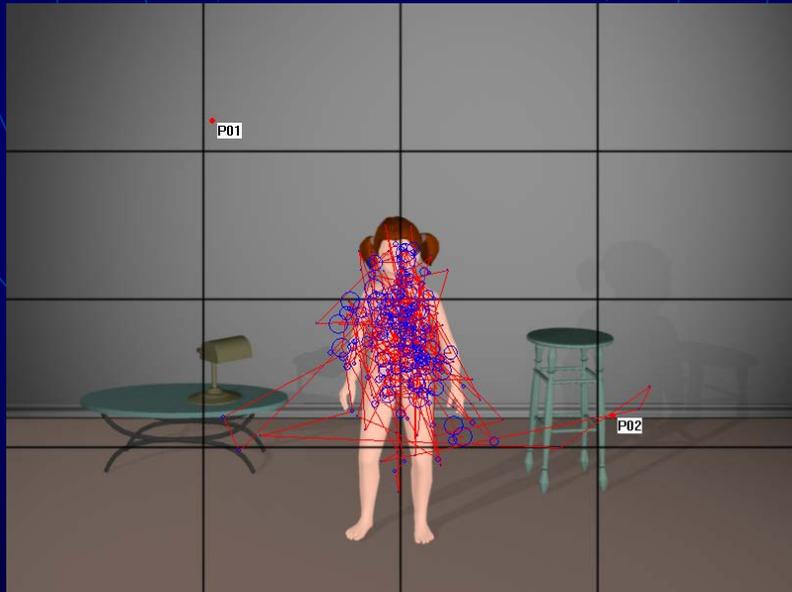
Female adult avatar



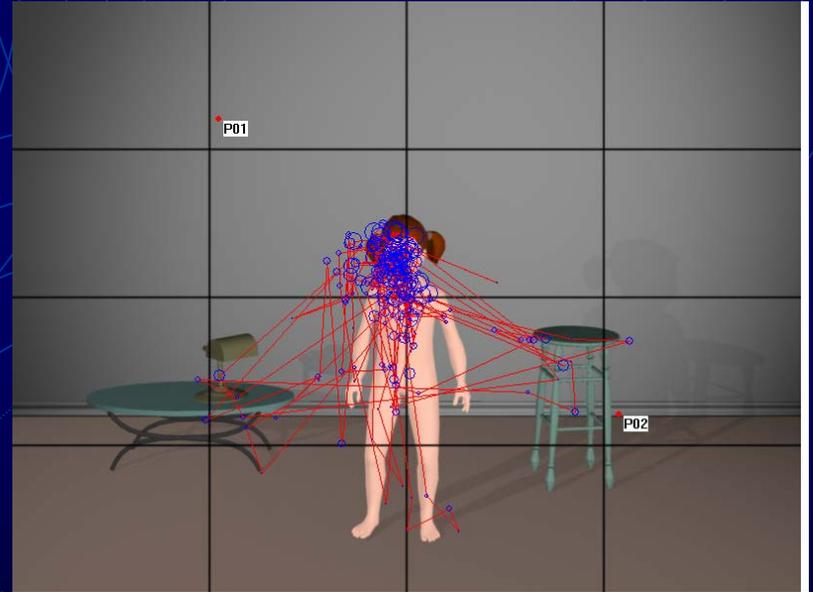
4.2.3 – Paedophile vs normal

Female child avatar

Paedophile



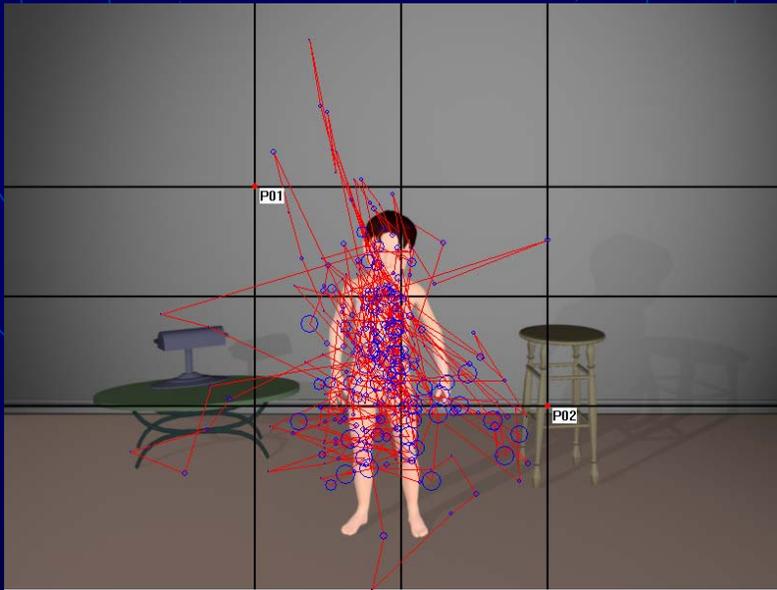
Normal



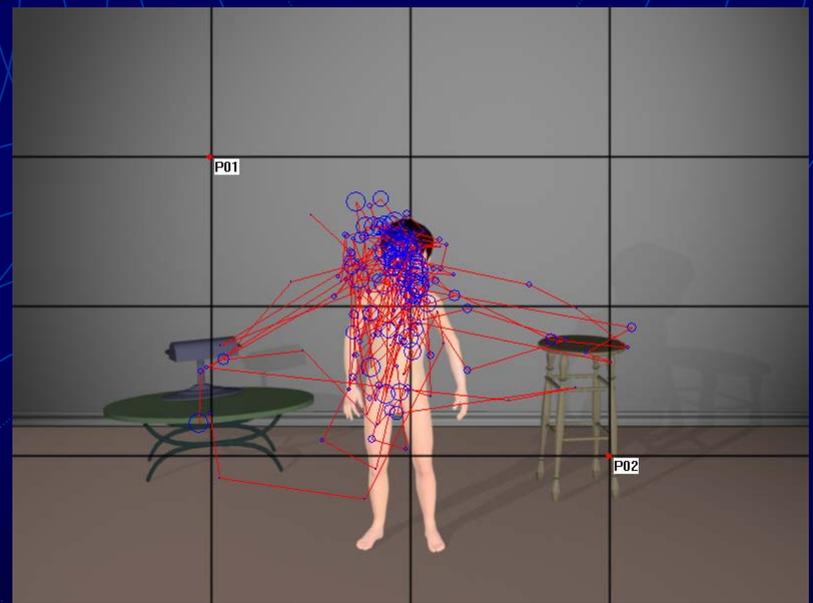
4.2.4 – Paedophile vs normal

Male child avatar

Paedophile



Normal

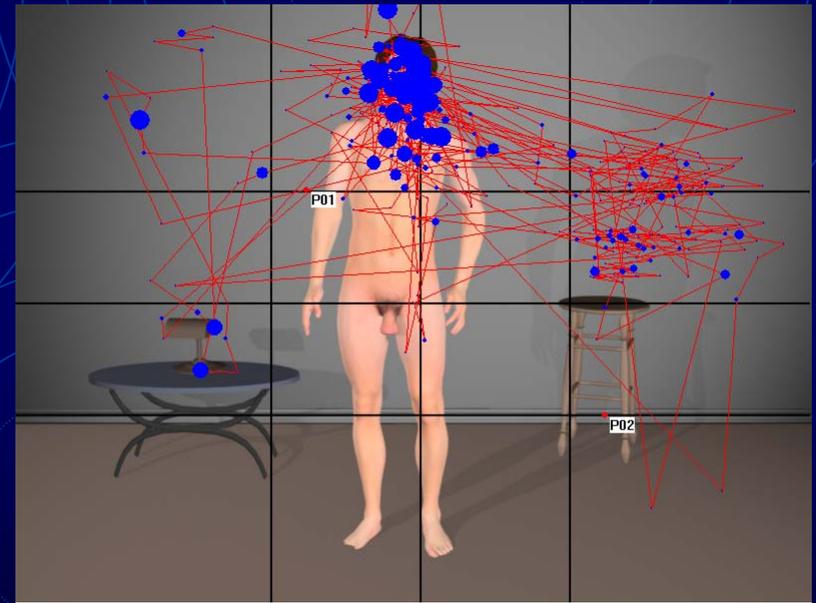
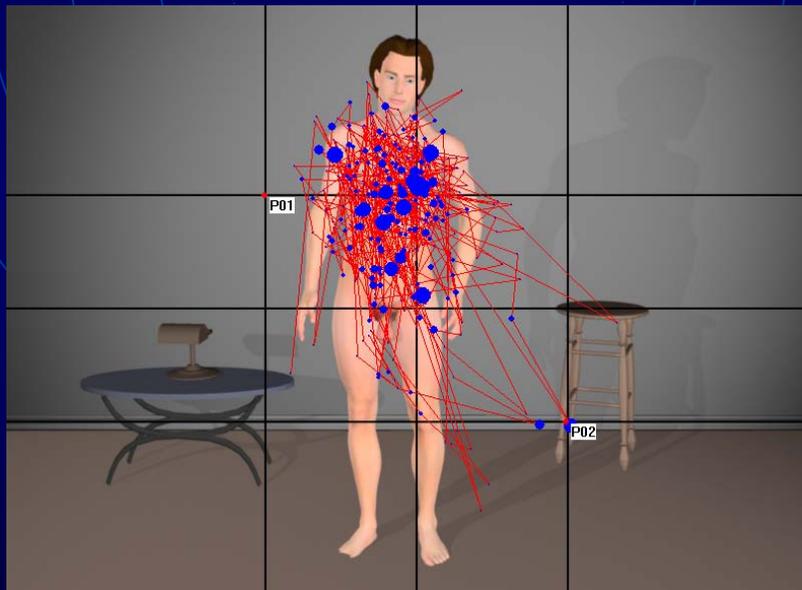


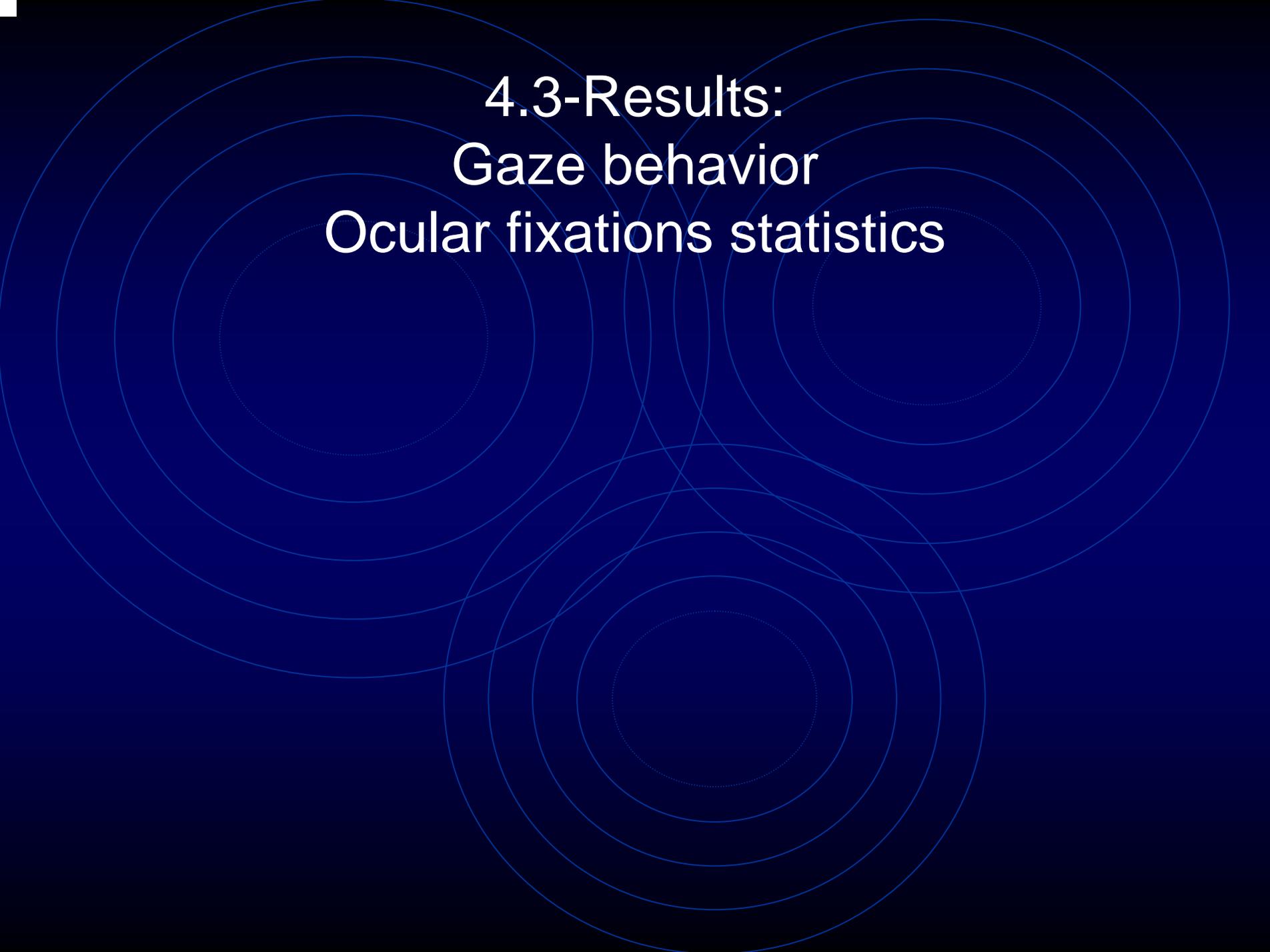
4.2.5–Homosexual (paedophile) vs heterosexual (normal)

Male adult avatar

Homosexual

Heterosexual





4.3-Results:

Gaze behavior

Ocular fixations statistics

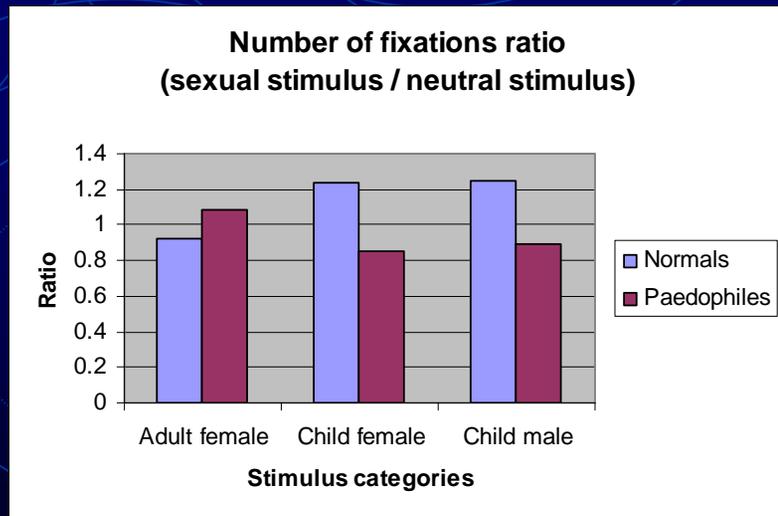
4.3.1-Ocular fixations statistics: ratios

- 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 ($F(1,5)=12.694, p=0.016$) as well as with the male child avatar ($F(1,5)=12.321, p=0.017$); 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 ($F(1,5)=9.382, p=0.021$); fixations duration tended to be longer (n.s.)
- Distinct gaze patterns between paedophiles and normals

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



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

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