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Comparing multiple indirect measures of sexual interest with eye-tracking and pupil dilation

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Introduction

Indirect measures of sexual interest have attracted considerable attention over the last decade. However, progress is needed in establishing the validity of these tasks as diagnostic tools. Eye movements may provide a remarkably direct measure of sexual attention. In addition, during visual processing, observers' pupils automatically increase in size (dilate) as arousal increases. In eye-tracking, pupil size can be recorded with millisecond timing and linked directly to the material that a person is viewing. Eye-tracking may prove useful as an assessment measure, and may also aid in strengthening the validity of existing measures and in understanding the cognitive processes involved in processing sexually appetitive material. The aim of this study was to examine the relationship between eye-tracking and indirect tasks in measuring adult sexual orientation and child molesting proclivity in a student sample.

Participants

29 University students (22 straight, 5 gay, 2 bisexual)

Measures

Eye Gaze, Pupil Dilation, and Viewing Time Tasks

- Eye gaze and pupil dilation were recorded during a free viewing task — images of adults or children on a beach shown for 10 seconds each.
- Gaze, dilation and response time were recorded in a viewing time task where participants were asked how sexually appealing images were. Viewing time images included people on a beach, images from the Not Real People image set (NRP; Laws and Gress, 2004), and a set of morphed (not real) adults (Ó Ciardha, 2010).

Pictorial Modified Stroop Task

Participants are asked to identify as quickly as possible the colour in which an image is presented. A systematic slowing down of response times to a certain blocks of image types (e.g. adult females) is interpreted as a possible indicator of (sexual) salience. Images were from the NRP and Ó Ciardha (2010) sets (also used for CRT and IAT).



Choice Reaction Time Task (CRT)

The CRT also interprets slower responses as indicative of sexual salience, but asks people to quickly identify the location of a dot superimposed on an image. While the Stroop task presented blocks of the same image category, the CRT used smaller clusters and separated children into older (Tanner 3 & 4) and younger (Tanner 1 & 2).

Implicit Association Test (IAT)

The IAT examines the speed with which images or words are categorised when certain concepts are paired (e.g. male and sexual or female and nonsexual) and compares these response times to those when opposite categories are paired (e.g. female and sexual or male and nonsexual). Faster responding is interpreted as an indicator of stronger associations between paired concepts. Unusually for IAT designs we presented blocks of adult and child images within one IAT, allowing us to examine whether facilitation effects were stronger to adult or to child stimuli.



Interest in Child Molestation Scale

Along with explicit attractiveness ratings of adult and child stimuli from the viewing time task, we examined child molestation proclivity using the Interest in Child Molestation Scale (Gannon & O'Connor, 2011). This measure presents sexual offending scenarios and asks participants to rate how arousing or enjoyable they would find such a situation and whether they would have done the same. We concentrated on low-force scenarios as these had the most variability in responding.

Adult sexual orientation

Difference scores were calculated between responses to adult male and female stimuli (i.e. differences in response times, pupil dilation, or % of eye gaze fixations to the body).

- All paradigms, except one pupil dilation measure, significantly discriminated between gay and straight participants.
- IAT was most predictive. See table on right that shows the results of ROC analysis. An AUC of 1 represents a perfect trade-off between sensitivity and specificity in discriminating between participants based on orientation.

	Sexual Orientation		
	AUC		95% CI
Difference Scores Between Adult Male and Female Stimuli			
Viewing Time	.973**	.914	1.000
Pictorial Stroop Task	.918**	.792	1.000
Choice Reaction Time	.791*	.566	1.000
Implicit Association Test	1.000**	1.000	1.000
Pupil Dilation (freeview - beach scenes)	.882**	.728	1.000
Pupil Dilation (viewing time - beach scenes)	.664	.443	.884
Pupil Dilation (viewing time - NRP Tanner 5)	.900**	.778	1.000
Pupil Dilation (viewing time - Ó Ciardha, 2010)	.964**	.896	1.000
Eye Gaze (freeview - % fixations to body)	.818*	.631	1.000

* $p < .05$ ** $p < .01$

Relationship between measures

- For adult stimuli, response time tasks had significant medium-to-strong correlations with at least one eye-gaze or pupil dilation measure, indicating a large amount of shared variance across tasks.
- Strength of correlations between response time tasks varied — only the pictorial modified Stroop task was correlated with all other response time tasks.
- For child stimuli the relationship between tasks was weaker — e.g. for female child stimuli there were no significant correlations across response time tasks or eye-tracking measures.

Relationship with molestation proclivity

As the majority of the sample identified themselves as having a sexual interest in females, the investigation of child molestation proclivity focused on stimuli involving female children and straight participants ($n = 22$).

- Sexual appeal ratings of images of female children were significantly and positively correlated with the overall proclivity scores for low-force child molestation scenarios.
- Reported arousal to child molestation was strongly correlated ($r = .51, p = .016$) with reaction times to older girls (Tanner stages 3 & 4) in the CRT task, but not younger girls (Tanner Stages 1 & 2). Responses to older female children also correlated with self-reported enjoyment of the abuse scenario ($r = .48, p = .025$).
- The relationship between pictorial Stroop task female child images and self reported arousal to scenarios was moderate-to-strong and marginally significant ($r = .42, p = .051$).
- The strength/speed of associations between female children and the construct "sexual" in the IAT was correlated with sexual appeal ratings of female children: $r = .45, p = .037$.
- Pupil dilation did not demonstrate a clear relationship with child molestation proclivity. However, straight participants showed greater dilation to adult and older female children than younger children.
- In the freeviewing task the percentage of eye gaze fixation falling on the lower body of female children had a strong correlation with arousal towards ($r = .528, p = .012$) and enjoyment ($r = .6, p = .003$) of offending scenarios. It was also the best predictor of which participants did not emphatically reject some degree of arousal to the scenarios, $AUC = .915, p = .001, 95\% CI [.787, 1.000]$

Conclusion & Future Directions

Tasks show a high level of agreement looking at adult orientation. However, different paradigms had different strengths in exploring arousal to child stimuli and molestation proclivity. Eye-tracking and pupil dilation is clearly a potentially useful technique for the assessment of sexual interest. Future work should:

- Increase sample size for greater statistical power and to establish norms (data collection is ongoing)
- Refine eye-tracking and pupil dilation paradigms
- Use measures with an offending population
- Include comparisons with phallometry through collaboration



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