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The interaction between perceived chronological age and physical sexual development in attractiveness judgments made by people who are attracted to children

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Abstract

The measurement of sexual attraction patterns has significance in relation to the assessment and treatment of people who may have caused sexual harm. However, it is also important to understand the drivers of sexual attractions within the community. In recent times there has been an increased level of interest in people with attractions to children, but minimal attention has been paid to fully understand how different indicators of age might influence their level of attraction to a range of child targets. In this paper we report three studies using online samples wherein we developed a merged person stimulus set that allowed us to manipulate the configuration of a target's apparent age (depicted by facial features) and their physical development stage (depicted by non-facial bodily features). In Studies 1 and 2 we find that our merged person set performs comparatively well on indices of realism and estimated age, while in Study 3 we find that manipulating the apparent age of a body influences the attractiveness judgments made by people with attractions to different age groups. We discuss the theoretical and practical significance of our findings within the context of accurate assessment techniques.

Keywords: pedophilia, Tanner stages, age of attraction, sexual attraction, hebephilia

The social scientific literature exploring sexual attractions to children is growing at a rapid pace. In recent years, researchers and clinicians have sought to understand the nature of such attractions (Blanchard et al., 2009; Cantor et al., 2004, 2015; Jahnke et al., 2022; Schmidt et al., 2013; Stephens et al., 2017), how to break down barriers to help-seeking (Goodier & Lievesley, 2018; Levenson et al., 2017; Levenson & Grady, 2019; Parr & Pearson, 2019), and how to effectively work with this population in clinical settings (Lievesley et al., 2022; Lievesley & Harper, 2021b; McPhail et al., 2018; Schmidt & Niehaus, 2022; Stephens et al., 2021). However, in conducting this work we typically rely on imprecise measures of such attractions, and define people as belonging to specific groups in accordance with their stated 'age of attraction' in online surveys (Lievesley & Harper, 2021a; Ó Ciardha et al., 2022).

This shorthand way of determining primary attraction patterns may be flawed in multiple ways. For example, we know that attraction is not typically based solely on the age of a target, but instead is the result of a cognitive calculation about attractions to this alongside a target's physical appearance and any personality traits that may be ascribed to them (e.g., Carter et al., 2014; Little et al., 2006). Many sources of information are taken into account in such a mental process, including an appraisal of physical attractiveness, an estimate of age, and a computation of a potential target's mate value (which may include evaluations of both their physical and psychological characteristics. As such, in this paper we report the results of a project that investigates how attractiveness judgments are the product of an interaction between a target's physical sexual development and their perceived chronological age among those with attractions to children. We do so in an effort to advance the current evidence base related to attractions to children, and to move us away from a simplistic categorization of people who experience such attractions on the basis of subjectively reported ages of attraction.

Defining Sexual Attractions to Children

Definitions and key terms used to describe sexual attractions to children vary across the literature as a function of the author and their disciplinary perspective (Feelgood & Hoyer, 2008; Harrison et al., 2010). Although most academic and clinical work focuses on pedophilia, this is just one form of such attractions, which Seto (2017) classified under the label of chronophilias. A chronophilia is a distinct sexual attraction pattern where the focus of attraction is directed (usually either dominantly or exclusively) towards targets of particular age categories, or targets at different phases of physical and/or sexual development related to the Tanner stages. These stages relate to the physical sexual development of bodies in terms of breast development (female targets), genital growth (male targets), and pubic hair density (Tanner, 1962). Seto's (2017) taxonomy divides sexual attractions to different ages into the following categories:

- Nepiophilia: attractions to young infants, typically up to age two years; no physical or sexual development and very young bodily features (Tanner stage 1).
- Pedophilia: attractions to prepubescent children, typically up to age ten years; no evidence of pubescent physical or sexual development and child-like bodily features (Tanner stage 1-2).
- Hebephilia: attractions to children emerging into puberty, typically between the ages of 11-14 years; physical and sexual development markers indicate some degree of sexual maturity (e.g., early breast growth in girls; Tanner stage 2-3).
- Ephebophilia: attractions to older teenagers who have experienced (or who are nearing the end of) puberty, typically aged over 14. Physical and sexual development appears complete or close to complete, but the target is still legally a child (Tanner stage 4). The validity of this category is contested within the

literature as sharing common arousal-related markers with hebephilia and telieophilia (e.g., Blanchard et al., 2009).

- Teleiophilia: attractions to sexually mature adults of reproductive age, typically between 18-40 years. Physical and sexual development is complete (Tanner stage 5).
- Mesophilia/Gerontophilia: Attractions to mature adults who are typically in the middle ages (mesophilia) or older ages (gerontophilia) of their lives.

There is fervent debate within the scientific literature (and broader society) about exactly how to classify such chronophilias. For some, these attraction patterns may represent forms of sexual orientation for age, owing to their resistance to chance efforts, apparent early ages of onset, and the congruence between sexual and romantic attractions (Mundy, 2022; Seto, 2012). However, this designation is controversial due to its implied links to normative sexual orientations (e.g., homosexuality) and the possible stigma transfer that could occur to other groups, as well as the variable exclusivity of child-directed attractions among many who experience them (Lievesley et al., 2020; Martijn et al., 2020). For others, sexual attractions to children represent paraphilic interests, which mean that they are patterns of attraction that fall outside of the expected or accepted norms of society (for a review, see Lievesley & Harper, 2021a). This latter conceptualization is consistent with clinical categorization, where pedophilic disorder is listed under the paraphilic disorders heading within the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM5-TR; American Psychiatric Association, 2022). Importantly here, pedophilia (as a pattern of attraction) is not designated as disordered, per se, but rather becomes this when such attractions are accompanied by harm or significant distress being caused to oneself or others (Blanchard et al., 2009; Lievesley & Harper, 2021a).

Variations in the conceptualization of sexual attractions to children also lead to conflations between the labels used to describe such attraction patterns (e.g., pedophilia) with their corresponding criminal behaviors (e.g., child sexual abuse). This conflation is seen across society, including in media reports, scientific publishing, and legislative debates (Feelgood & Hoyer, 2008; Harper & Hogue, 2017; Harrison et al., 2010). However, we know that not all of those who experience sexual attractions to children will commit crimes (see Cantor & McPhail, 2016), while less than half of those convicted of sexual crimes against children meet clinical cutoffs for pedophilia (Seto, 2009). With this in mind, understanding how to accurately measure and designate somebody's sexual attraction patterns becomes an important scientific and clinical endeavor.

Measuring Sexual Attraction Patterns

With the accurate measurement of sexual arousal patterns being important in a theoretical sense, as well as being pivotal to the effective assessment and treatment of individuals with sexual convictions in forensic settings, a consideration of measurement approaches is necessary. There are a range of different methods that have been adopted by researchers and clinicians when measuring sexual attractions, with each of these having different levels of invasiveness and sensitivity. The ostensible gold standard assessment method relates to genital response, which means examining genital arousal through erectile response (in men) or blood flow to the genital area (in women). In meta-analytic work, such methods have been shown to be a robust indicator of sexual interest, with genital response correlating to self-reported subjective arousal (see Chivers et al., 2010). Genital arousal to child-related stimuli has also been found to be an evidence-based predictor of sexual reoffending against children among people with such convictions (McPhail et al., 2019).

Despite the apparent success of genital arousal measures in identifying sexual arousal patterns, these methods come with inherent limitations in terms of their invasive nature and

the difficulty in administering them at-scale. As such, a range of indirect cognitively-based measurements of assessing sexual interests have been developed. These are tasks that measure sexual arousal in such a way that the participant in the test is not asked directly about their attractions or arousal patterns. The most well-validated of these are viewing time tasks and the implicit association test (IAT).

With regard to viewing time, the process of sexual content induced delay means that people tend to fixate on stimuli that they find attractive, leading to longer viewing times (Mokros et al., 2010). This method has distinguished people in terms of their sexual orientations in traditional adult samples (Rönspies et al., 2015), as well as discriminating between those with and without sexual offenses against children in forensic contexts (Schmidt et al., 2017). In the current context, although viewing time does seem to be predictive of sexual interests in children it was not found to meaningfully discriminate between community-based men with or without past sexual offenses (Pezzoli et al., 2022).

The IAT is a reaction time task that requires respondents to quickly classify stimuli using a computer, usually by pressing a computer keyboard button. Targets and attributes share a response key (e.g., ‘child’ and ‘sex’ may share one response key, while ‘adult’ and ‘non-sex’ share another), and the task logs reaction times when classifying stimuli when targets are paired with alternative attributes (Schimmack, 2021). IATs have been found to distinguish between teleiophilic individuals who are heterosexual or homosexual (e.g., Snowden & Gray, 2013). In the context of attractions to children, it has also distinguished between those with convictions for child sex offenses and those without them (Babchishin et al., 2013). However, this review did find that such a distinction was stronger in IAT studies where ‘child’ was paired with the attribute ‘sex’ than it was when the attribute was ‘sexy’. This calls into question whether those with convictions are actually being found to have a

stronger attraction to children, or whether they more easily associate children with the act of having sex.

The Current Project: Beyond Tanner?

Irrespective of the specific methods that are adopted, there is also a need to consider the stimuli used in studies of sexual arousal and attraction. Due to ethical issues in using materials that depict real children, most studies make use of computer-generated stimuli that have questionable levels of realism (e.g., Dombert et al., 2013; Mokros et al., 2013; Renaud et al., 2010). In the creation of such materials, computer models generate images of people before modifying their ages using a morphing process. However, this morphing process has often led to stimulus sets wherein images contain heads and bodies that are visibly not from the same person (e.g., Laws & Gress, 2004) or that lack a level of photorealism (Mokros et al., 2013; Renaud et al., 2010). In addition, stimuli are usually categorized according to Tanner stages, with preferential responding (e.g., greater genital response or longer viewing times) to targets with certain markers of physical development being used as indicators of chronophilic orientations. However, this reliance on a single characteristic (outward physical markers of sexual maturity) omits crucial information about a person that may lead to changes in both self-reported and physiological levels of attraction.

It is important to consider this limitation of over-reliance on single cues within the context of the broader literature on person perception. Attractiveness judgment is a multifaceted phenomenon, encompassing elements of biology (e.g., physical indicators of attractiveness, such as facial symmetry and body shape) and psychological appraisals of personality, social status, and similarity (Li et al., 2013; Little et al., 2011). From an evolutionary perspective, men typically perceive more youthful faces as more attractive due to these indicating a greater degree of fertility (Gallup & Frederick, 2010; Little, 2015; Thornhill & Grammer, 1999). However, this youthfulness preference has limits, with puberty

being a key milestone for determining attraction (vs. aversion) among teleiophilic individuals. That is, if youthfulness is attractive for men due to its fertility advantages, it makes sense that youthfulness among postpubertal targets (rather than prepubertal targets) is associated with increased levels of self-reported attraction. For this reason, some commentators have questioned the validity of the ephebophilic chronophilia due to its conceptual closeness to teleiophilia from an evolutionary standpoint (Blanchard et al., 2009).

Thinking about the literature on age estimation in a broader sense, people appear to have an innate bias for using facial features as a basis for estimating the age of a target (Murphy, 2011). For instance, an increased degree of closeness of facial features appears to be encoded as indicating youth (Albert et al., 2007), and in turn, this youthfulness is associated with beauty (Sutherland et al., 2013). There is minimal evidence of bodily features (e.g., breast growth in female targets) as being specifically used to predict age, which makes conceptual sense when considering the variety of body shapes and types that adults may exhibit. From this, we might predict that although physical development (i.e., Tanner staging) might provide some baseline for determining attraction patterns, there will be nuances in levels of attraction to different Tanner stage as a function of perceived age (as manipulated by other variables, such as facial features).

As a contemporary example, the rise in popularity of ‘teen’ pornography (wherein adult performers play the role of younger targets) highlights a potential mismatch between a target’s Tanner staging and the levels of attraction experienced by a perceiver. In a content analysis of such pornographic material, Vannier et al. (2014) found how a typical female actor possessed attributes that may be linked to an early Tanner stage, such as no pubic hair and small breasts. The users of such material, if only being judged on their bodily preferences, might therefore be classified as hebephilic, even though they experience their attraction as being directed towards an adult (determined by knowing the performer is above

the legal age for appearing in such material[1]). This risks people being classified as having attractions to children based on an individual aspect of a potential sexual target (i.e., outward indicators of sexual development) in a manner that may not align with their experience of sexual arousal.

In light of the potential issues with using Tanner staging as an indicator of chronophilic orientation, in this work we address a gap in the literature by investigating the interaction between these variables (i.e., chronological age and physical development) in attractiveness judgments. In addition to this, we also have concerns about the use of AI-generated virtual stimuli sets with regard to the extent to which we can draw in terms of attractions to real people. In this project, we therefore looked to achieve two aims. The primary aim was to understand how attractions to targets who have reached different Tanner stages of sexual development are affected by the ostensible age of these targets, with use manipulating age through the switching of faces. A secondary aim was to develop a new stimulus set where we merge copyright-free stock photographs of real people in an attempt to address issues related to the lack of realism in existing image sets that rely on computer-generated models. As such, the significance of our contribution to the existing literature is two-fold, and spans both the theoretical and methodological domains.

Our systematic approach sees us first establish baseline ratings from community members for the perceived ages of various stock image faces and sexual development of bodies from the same stock photographs (Study 1). We then recruit an independent community sample to obtain ratings of the perceived ages and realism of stimuli made up of bodies merged with differently aged faces (Study 2). This pilot work is necessary for us to produce appropriate stimuli for use in our confirmatory research, where we address our

[1] This observation is limited to professionally-created pornographic material, and is not meant to ignore the availability of child sexual exploitation material involving minors.

primary aim by investigating how ratings of the attractiveness of these merged person stimuli is dependent upon their age/development configurations (Study 3). In this final study, we expected those with younger chronophilic orientations (i.e., pedophilic and hebephilic individuals) to be most attracted to merged person stimuli with less developed bodies, while ephebophilic and teleiophilic were expected to rate more developed bodies as most attractive. However, we expected differences to emerge as a function of the ostensible age of the merged person. For example, even among merged person stimuli with less developed bodies, hebephilic individuals were expected to rate bodies with adolescent faces as more attractive than the same body merged with a child's face. Similarly, although ephebophilic and teleiophilic individuals were expected to rate adult bodies as attractive, we expected teleiophiles' (comparative) ratings of the attractiveness of such bodies to be diminished when they were paired with adolescent faces (vs. the faces of adults).

Study 1

In Study 1 we set out to explore community ratings of a range of pilot stimuli that were selected for inclusion in our stimulus set to be used in our confirmatory research. In doing so, we sought to map such responses against accepted stages of sexual development (for body stimuli) and chronophilia-related age benchmarks (for face stimuli).

Methods

Participants

We set out to recruit a sample to pre-rate our indicative stimulus set. Using guidelines from past stimuli development studies such as work on the Virtual People Set (Dombert et al., 2013; *n*s = 20-110), we planned to recruit between 100-150 people. In doing so, we wanted to retain as much information from each participant as possible, with an arbitrary target of 100 ratings per stimulus. Using broad advertisement on local community social

media groups and public Reddit forums for survey recruitment (e.g., *r/SampleSize*) we had 142 people click on our survey link within a two-week period in February 2022. After removing those who did not provide their consent to participate (n = 1) and cases with no data (n = 13) we were left with a final sample of 128 participants. Of these, 67 identified as female (52.8%), 50 as male (39.4%), eight as non-binary (6.3%), and three people did not disclose their gender. The average age of the sample was 31.6 years (SD = 10.8 years; range = 18-65 years).

Materials

Demographics. Participants provided information about their gender (male / female / non-binary / other) and their age (in years).

Source images. We accessed images of adults and children using free stock photo websites. All images were copyright-free, meaning that those depicted in them (or their legal guardians, in the case of children) waived any rights to the non-commercial use of the images. We sourced 30 images per sex, with six images per Tanner stage (this was determined using a consensus vote within the research team, with the aim being to establish the accuracy of these determinations within the data analysis). Bodies were digitally separated from heads to allow for the testing of Tanner stage estimates (for body stimuli) and age estimates (for face stimuli). This meant that participants were exposed to 120 stimuli in total (60 per sex; 30 heads[2] and 30 bodies). To control for potential confounding variables, any image backgrounds were removed. All models were of White ethnic origin, were wearing swimwear, had neutral or positive facial expressions, and posed facing forward.

[2] For head stimuli, five stimuli were presented per chronophilia, with an additional five that were difficult to determine between the ephebophilic and teleiophilic categories.

Ratings. For each image, participants were asked to provide one rating. For images of bodies, participants were asked to provide a rating for the question "How sexually developed do you think this person is?". A response was given using a five-point scale anchored from 1 (Not at all sexually developed) to 5 (Fully sexually developed). As such, we were able to ascertain which Tanner stage participants would place each body into, without using technical language about specific stages of sexual development. For images of faces, we simply asked participants to state how old they believed the person to be using a free-text response box. The specific wording used was "How old in years do you think this individual is?".

Procedure

Participants were recruited for an online survey (hosted on Qualtrics) designed to rate the appearance of various pictures of different bodies using the aforementioned methods. After clicking on the study link participants provided their informed consent, followed by their demographic information. All pictures (bodies and faces of both sexes) were then presented in a randomized order. This prevented any order effects related to image type, sex, or apparent age, and prevented participants from responding in any form of pattern. Participants were asked to rate as many images as possible, and that data withdrawal could be done by contacting the research team using their unique participant identifier, which they created after providing their consent. As such, partial datasets for individual participants were retained unless we were explicitly contacted and asked to remove them (this did not happen for any participant). All participants reaching the end of the full survey received a comprehensive debrief detailing the study aims. This procedure received a favorable ethical opinion from the [committee details blinded for review].

Results

In this initial pilot study we were looking for faces and bodies that clearly mapped on to specific chronophilic categories (assessed via age estimates for faces) and Tanner stages (assessed by developmental gradings for bodies). We were seeking two stimuli per chronophilia and Tanner stage within each sex.

For face data, we set cut-offs for age-based upon Blanchard's (2009) suggestions (e.g., 0-3 for nepiophilia, 4-10 for pedophilia, 11-14 for hebephilia). We determined a stimulus to be eligible for further consideration if the sample's mean age estimate fell within this age span, and the range was also within these boundaries. For body data, we started with the aim of using a modal rating approach, whereby we would consider bodies to be reliably within a particular Tanner stage if more than 50% of participants rated it as being so. Outcome data are represented in Tables in the online supplement, with these Tables also indicating which stimuli we retained for subsequent analyses. As demonstrated in the supplemental material, participant age and sex were broadly unrelated to stimulus judgments.

Average scores for age generally mapped on to what was expected. However, the ranges of the age estimates varied significantly and often spanned multiple chronophilic groups. As such, we made the pragmatic decision to merge pre-pubescent images (up to early hebephilic ages), pubescent images (early hebephilic ages through to early ephebophilic ages), and post-pubescent images (early ephebophilic ages and above) into three distinct categories.

Similar issues were encountered in relation to the data relating to bodies, where agreement was relatively high for Tanner stages 1 and 5, but variable for stages 2-4. When looking at the estimates of Tanner stages we again found evidence that Tanner stage 2 bodies were likely to be classified similar to younger (less developed) bodies, and Tanner stage 4 bodies were more likely to also be classified as being fully physically developed. Tanner stage 3 bodies had scores which spanned the three middle stages, indicating a degree of

uncertainty about their Tanner staging. Owing to these data, we again grouped images into 'prepubescent' (Tanner stages 1 and 2), 'pubescent' (Tanner stage 3), and post-pubescent (Tanner stages 4 and 5) categories.

Study 2

Having identified face and body images that correspond to chronophilic categories for age (face stimuli) and Tanner stages for physical sexual development (body images) in Study 1, we sought to combine different images of faces and bodies into realistic-looking images of people for inclusion in an attractiveness rating task. As such, Study 2 looked to obtain ratings of realism and estimated age for a variety of merged person images.

Methods

Participants

We recruited an opportunity sample for this study using the crowdsourcing platform 'Prolific'. This allowed us to collect data quickly while providing small monetary rewards to participants (in this study, the remuneration for participation was £1 / $1.30). We had 170 participants take part, and no missing data. Of these, 85 identified as female (50%), 82 as male (48%), and three as non-binary (2%). The average age of the sample was 40.75 years (*SD* = 13.55 years; range = 18-75 years). 54% of the sample were parents.

Materials

Demographics. We asked participants to report their gender (male / female / non-binary / other), their age (in years), and whether they had children.

Images. Using the head and body stimuli that passed our thresholds for inclusion in Study 1, we constructed a set of images that merged differently-aged heads onto bodies. We created 96 images of merged people (48 for each sex), taking into account the

appropriateness of the potential configurations. For example, we did not merge prepubescent heads with adult bodies (or vice versa). Prepubescent bodies were merged with prepubescent and pubescent heads, adult bodies were merged with pubescent and post-pubescent heads, and pubescent bodies were merged with all categories of head. Examples of merged person pictures are presented in Figures 1a and 1b.

--- Insert Figures 1a and 1b Here ---

Ratings. For each merged person image, we asked participants to respond to three questions. The first question was related to the realism of the image ("Please state how realistic you believe the image to be.") using a ten-point scale anchored from 1 (Definitely not a real person) to 10 (Definitely a real person). We then asked participants to estimate the age of the merged person using a free-text response box. Finally, participants gave a rating of the confidence that they had in their age estimate ("How confident are you with your age estimate?") using a six-point scale anchored from 1 (Not at all confident) to 6 (Very confident).

Procedure

Participants were recruited for an online survey (hosted on Qualtrics) which asked them to rate the appearance of various pictures. The study link provided information about the task, and asked participants to provide their consent before they self-created a participant identification code. Demographic information was collected before all of the merged person pictures were presented. All pictures were then presented in a randomized order to prevent participants from responding in a pattern. As in Study 1, participants were asked to rate as many images as possible, with withdrawal being possible by contacting the research team with their unique participant identifier (i.e., partial dataset were retained, unless participants explicitly withdrew). No participants contacted us to withdraw their data. All participants

reaching the end of the full survey received a comprehensive debrief detailing the study aims. This procedure received a favorable ethical opinion from the [committee details blinded for review].

Results

In this study we were investigating the levels of realism inherent in our stimulus set (i.e., did participants believe that the stimuli looked like they depicted real people?), and the appropriateness of the age combinations of the head-body configurations. Acknowledging both (a) the merged nature of the stimuli used, and (b) the low levels of realism reported in similar studies using computer-generated stimuli (e.g., Dombert et al., 2013), we set a conservative threshold of 5 (out of a possible 10) for stimuli to be included in subsequent work. With regard to age estimates, we specifically looked at data for images with consistent configurations (e.g., pubescent heads and bodies, adult heads and bodies) to ensure these were within expected bounds. Outcome data are presented in Tables in the online supplement. As demonstrated in the supplemental material, participant age and sex were broadly unrelated to stimulus judgments.We fell slightly short of our aim of having two stimuli per head/body configuration on the basis of realism scores. This was met for most categories. However, we did not meet this target for the following configurations:

- Prepubescent heads on pubescent bodies (both sexes)
- Pubescent heads on prepubescent bodies (female images)
- Pubescent heads on pubescent bodies (both sexes)
- Pubescent heads on adult bodies (male images)

For these configurations, we selected those images that had realism ratings that were concordant with prior stimulus set development work (e.g., Dombert et al., 2013). Where multiple images met the criteria for inclusion, we made a decision based upon a visual inspection of the images, and inclusion of a spread of ages within each potential chronophilic

category (e.g., younger and older teenage ages within the hebephilic conditions, and younger and older pre-teen ages within the pedophilic conditions). Age estimates for all images were broadly within the expected boundaries, taking into account the discordance between head and body 'ages'. Levels of confidence in participant judgments were generally low, which (when also taking the realism data into consideration) may indicate that participants were aware that our stimuli were not real people. However, our realism data do suggest that, broadly speaking, our images possess an equivalent degree of reality than other stimulus sets that use computer-generated images, while having the added advantage of being truly photorealistic. For example, the average realism score in the final selected images in our newly developed set was 5.51 (where the possible score ranged from 1-10). In comparison, realism scores (transposed onto our ten-point scale) for computer-generated stimuli in Dombert et al.'s (2013) work were approximately 6. Given the scale of use of the Virtual People Set (Dombert et al., 2013), we believe that our merged person stimulus set is at least equivalent in terms of realism validity, and potentially preferable due to its photorealistic nature.

Study 3

Having developed several realistic images of merged people, in Study 3 we conducted our confirmatory analyses, and set out to test how manipulating the configuration of chronological age (face images) and Tanner-based physical sexual development (body images) affects levels of attractiveness reported by people with attraction patterns that involve children. In doing so we can determine the extent to which these different indicators of childhood influence attraction among those with different child-directed chronophilias.

Methods

Participants

We recruited participants for Study 3 from several places in an attempted to attract people who were both attracted to adults and children to the study. To target those attracted to adults, we used social media advertising (e.g., using community pages on Facebook, and Reddit forums related to sexuality) to recruit participants. To target those attracted to children, we posted study advertisements on prominent online peer-support fora. A total of 506 individuals clicked on the link to the study survey. However, three of these declined to provide their consent. We further removed eight participants for not meeting the minimum age criteria. This left a total valid sample of 495 participants. Owing to the analytic strategy to be employed, we retained only those participants who declared a chronophilic orientation with regard to male or female targets, and those with full data for at least one 'body' category (i.e., full data relating to all stimuli depicting adult bodies and/or pubescent bodies and/or prepubescent bodies). This led to the removal of 150 participants, leaving a final sample of 345 participants. Demographic information is presented in Table 1.

--- Insert Table 1 Here ---

Materials

Demographics. We asked participants to report their sex, age, and whether they were a parent[3]. We also asked about participants' self-identified chronophilic orientation by asking them to select one option from the following: "Attracted to those aged 10 or below", "Attracted to those between the ages of 11-14 years", "Attracted to those between the ages of 15-17 years", "Attracted to those over the age of 18 years". This was repeated for male and

[3] This demographic item was included to see whether parents and non-parents differed in their levels of self-reported attraction to our stimulus set due to their proximity to (and familiarity with) children of different ages. However, we found few differences in levels of attraction to the stimulus set as a function of this variable (*d*s < 0.35). As such, we did not include parental status in our analyses as a covariate.

female targets, with a final option for each question of "I am not attracted to males/females of any age at all".

Stimulus images and ratings. The merged person images identified as being suitable for further analysis in Study 2 were included here. A total of 28 images were used in the following configurations:

1. Pre-pubescent bodies (Tanner stages 1-2) with pre-pubescent and pubescent heads.
2. Pubescent bodies (Tanner stage 3) with pre-pubescent, pubescent, and adult heads.
3. Post-pubescent bodies (Tanner stages 4-5) with pubescent and adult heads.

This gives seven possible configurations, with two images used per configuration. To enhance reproducibility, all images used in Study 3 are available for download at https://osf.io/s3mwa/?view_only=2daa7e062c0a4655bb2e7fb3acd5139a. Participants rated images of both male and female targets. Each image was rated in terms of how sexually attractive the participant found the person to be using a 10-point scale anchored from 'Not at all sexually attractive' to 'Extremely sexually attractive'.

Procedure

Participants were recruited for an online survey (hosted on Soscisurvey, which allows for access via Tor browsers) which asked them to rate the attractiveness of various pictures. The study link provided information about the task, and asked participants to provide their consent before they self-created a participant identification code. Demographic information was collected before all of the merged person pictures were presented in a random order. Information about participants' chronophilic orientations was collected at the end of the survey before a comprehensive debrief detailing the study aims was presented. This procedure received a favorable ethical opinion from the [committee details blinded for

review]. The participants did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

Results

We ran a series of two-way analyses of variance (ANOVAs) to examine the effect of apparent chronological age (depicted by faces) on the attractiveness of people of various stages of physical sexual development (depicted by bodies) for those with different chronophilic orientations. ANOVAs were run separately for male and female stimuli, and separately for each body type (prepubescent, pubescent, adult). We were unable to include body type as a factor within a three-way ANOVA due to the number of levels pertaining to chronological age. That is, it would be unrealistic to place an adult face on a prepubescent body (and vice versa). Due to the number of comparisons being tested, all *p*-values that are reported here are corrected using the Tukey method. Visual depictions of the patterns in the data are presented in Figures 2a and 2b.

--- Insert Figures 2a and 2b Here ---

Male Stimuli

Descriptive statistics for the attractiveness ratings of male stimuli are presented in the online supplement.

Prepubescent Bodies. We ran a 2 (Face: Child vs. Adolescent; within-subjects) × 4 (Chronophilia: Pedophilia vs. Hebephilia vs. Ephebophilia vs. Teleiophilia; between-subjects) mixed ANOVA on attractiveness scores for male stimuli depicting merged people with prepubescent bodies. There was a significant main effect of face type on attractiveness ratings, $F(1, 219) = 10.48$, $p < .001$, $\eta^2_p = 0.05$. Here, bodies merged with child-like faces were rated as significantly more attractive than bodies with adolescent faces ($M_{diff} = 0.49$, $t(219) = 3.24$, $p = .001$, $d_z = 0.22$).

There was also a significant main effect of chronophilia, $F(3, 219) = 60.78$, $p < .001$, $\eta^2_p = 0.45$. This effect was attributable to significantly higher attractiveness ratings being given by pedophilic than ephebophilic ($M_{diff} = 3.55$, $t(219) = 5.98$, $p < .001$, $d = 0.40$) and teleiophilic individuals ($M_{diff} = 4.54$, $t(219) = 12.33$, $p < .001$, $d = 0.83$). Hebephilic individuals also rated images with prepubescent bodies as being significantly more attractive than both ephebophilic ($M_{diff} = 2.85$, $t(219) = 4.71$, $p < .001$, $d = 0.32$) and teleiophilic individuals ($M_{diff} = 3.83$, $t(219) = 9.95$, $p < .001$, $d = 0.67$). Pedophilic and hebephilic individuals, and teleiophilic and ephebophilic individuals, did not differ in their attractiveness ratings of stimuli depicting people with prepubescent bodies.

There was a significant interaction between the presented age of the face and participant chronophilia in relation to self-reported attraction to prepubescent male bodies, $F(3, 219) = 25.01$, $p < .001$, , $\eta^2_p = 0.26$. For hebephilic ($M_{diff} = 0.42$, $t(219) = 1.74$, $p = .664$, $d_z = 0.12$), ephebophilic ($M_{diff} = 0.03$, $t(219) = 0.06$, $p = 1.000$, $d_z < 0.01$), and teleiophilic individuals ($M_{diff} = 0.21$, $t(219) = 0.94$, $p = .982$, $d_z = 0.06$), attractiveness ratings were unaffected by the apparent age of the person (as per their facial features). However, higher attractiveness ratings were given for stimuli with child-like faces (vs. adolescent faces) by people with pedophilic attraction patterns ($M_{diff} = 2.21$, $t(219) = 9.99$, $p < .001$, $d_z = 0.67$).

Pubescent Bodies. We ran a 3 (Face: Child vs. Adolescent vs. Adult; within-subjects) × 4 (Chronophilia: Pedophilia vs. Hebephilia vs. Ephebophilia vs. Teleiophilia; between-subjects) mixed ANOVA on attraction to male stimuli depicting merged people with pubescent bodies. There was a significant effect of face type on attractiveness ratings, $F(2, 438) = 12.49$, $p < .001$, $\eta^2_p = 0.05$. This effect was attributable to higher attractiveness ratings being given to bodies with child faces in comparison to bodies merged with the faces of adolescents ($M_{diff} = 0.69$, $t(219) = 5.00$, $p < .001$, $d_z = 0.34$) or adults ($M_{diff} = 0.61$, $t(219) =$

3.36, $p = .003$, $d_z = 0.23$). There was no difference in participants' self-reported attraction to pubescent male bodies merged with adolescent or adult faces.

There was also a significant main effect of chronophilia, $F(3, 219) = 30.57$, $p < .001$, $\eta^2_p = 0.30$. This effect was driven by significantly lower attractiveness ratings being given by teleiophilic than pedophilic ($M_{diff} = -1.68$, $t(219) = -5.09$, $p < .001$, $d = -0.34$), hebephilic ($M_{diff} = -3.25$, $t(219) = -9.37$, $p < .001$, $d = -0.63$), and ephebophilic individuals ($M_{diff} = -2.53$, $t(219) = -4.71$, $p < .001$, $d = -0.32$). Hebephilic individuals were also more likely to rate stimuli with pubescent bodies as more attractive than those with pedophilic attractions ($M_{diff} = 1.56$, $t(219) = 4.57$, $p < .001$, $d = 0.31$). Ephebophilic individuals scored between hebephilic and pedophilic individuals in their attraction to pubescent bodies, but did not differ significantly from either group.

There was a significant interaction between the apparent age of the face and participant chronophilia in relation to attraction to adult bodies, $F(6, 438) = 45.85$, $p < .001$, $\eta^2_p = 0.39$. For both pedophilic and hebephilic individuals, attraction levels were higher when facial features indicated that the person was younger. Significant differences were observed between pubescent bodies with adult faces and adolescent faces (pedophilic individuals: $M_{diff} = 0.69$, $t(219) = 3.69$, $p = .015$, $d_z = 0.25$; hebephilic individuals: $M_{diff} = 1.10$, $t(219) = 5.41$, $p < .001$, $d_z = 0.37$), and again between adolescent faces and child faces (pedophilic individuals: $M_{diff} = 2.31$, $t(219) = 11.52$, $p < .001$, $d_z = 0.78$; hebephilic individuals: $M_{diff} = 1.54$, $t(219) = 7.03$, $p < .001$, $d_z = 0.47$). Self-reported ephebophiles' self-reported levels of attraction to stimuli with pubescent bodies were unaffected by the facial manipulation. For teleiophilic individuals, attraction levels increased concordantly with the facial age of the person being presented (i.e., older faces elicited more self-reported attraction). There was no significant difference in attraction levels to pubescent bodies when merged with a child's face

or an adolescent face (M_{diff} = 0.29, t(219) = 1.42, p = .959, d_z = 0.10), and again a difference when the face depicted adulthood (M_{diff} = 0.93, t(219) = 4.83, p < .001, d_z = 0.33).

Adult Bodies. We ran a 2 (Face: Adolescent vs. Adult; within-subjects) × 4 (Chronophilia: Pedophilia vs. Hebephilia vs. Ephebophilia vs. Teleiophilia; between-subjects) mixed ANOVA on attractiveness scores attributed to male stimuli depicting merged people with adult bodies. There was no effect of face type on attractiveness ratings, F(1, 219) = 1.44, p = .231, η^2_p = 0.01. However, there was a significant main effect of chronophilia, F(3, 219) = 15.13, p < .001, η^2_p = 0.17. This effect was attributable to significantly higher attractiveness ratings being given by teleiophilic individuals than both pedophilic (M_{diff} = 2.20, t(219) = 6.08, p < .001, d = 0.41) and hebephilic individuals (M_{diff} = 1.75, t(219) = 4.63, p < .001, d = 0.31). Ephebophilic individuals were also more likely to rate stimuli with adult bodies as more attractive than both pedophilic (M_{diff} = 2.08, t(219) = 3.57, p = .002, d = 0.24) and hebephilic individuals (M_{diff} = 1.63, t(219) = 2.75, p = .032, d = 0.19). The respective comparisons of pedophilic and hebephilic individuals, and teleiophil and ephebophilic individuals, demonstrated how these groups did not differ in their attractiveness ratings of stimuli depicting adult bodies.

There was a significant interaction between the apparent age of the face and participant chronophilia in relation to attraction to adult bodies, F(3, 219) = 1.86, p = .012, η^2_p = 0.05. For pedophilic (M_{diff} = 0.03, t(219) = 0.23, p = 1.000, d_z = 0.02), hebephilic (M_{diff} = 0.02, t(219) = 0.19, p = 1.000, d_z = 0.01), and ephebophilic individuals (M_{diff} = 0.09, t(219) = 0.36, p = 1.000, d_z = 0.02) the self-reported level of attractiveness reported for stimuli with adult bodies did not significantly differ as a function of the facial manipulation. However, higher attractiveness ratings were given for stimuli with adult faces (vs. adolescent faces) by participants with teleiophilic attactions (M_{diff} = 0.47, t(219) = 3.93, p = .003, d_z = 0.27).

Female Stimuli

Descriptive statistics for the attractiveness ratings of female stimuli are presented in the online supplement.

Prepubescent Bodies. We ran a 2 (Face: Child vs. Adolescent; within-subjects) × 4 (Chronophilia: Pedophilia vs. Hebephilia vs. Ephebophilia vs. Teleiophilia; between-subjects) mixed ANOVA on attraction to female stimuli depicting people with prepubescent bodies. There was a significant main effect of face type on attractiveness ratings, $F(1, 277) = 38.69$, $p < .001$, $\eta^2_p = 0.12$. Here, bodies merged with child-like faces were rated as significantly more attractive than bodies with adolescent faces ($M_{diff} = 0.71$, $t(277) = 6.22$, $p < .001$, $d_z = 0.37$).

There was also a significant main effect of chronophilia, $F(3, 277) = 59.55$, $p < .001$, $\eta^2_p = 0.39$. This effect was attributable to significantly higher attractiveness ratings being given by pedophilic individuals than ephebophilic ($M_{diff} = 1.42$, $t(277) = 3.51$, $p = .003$, $d = 0.87$) and teleiophilic individuals ($M_{diff} = 3.12$, $t(277) = 12.72$, $p < .001$, $d = 1.90$). Hebephilic individuals also rated images with prepubescent bodies as more attractive than participants with either ephebophilic ($M_{diff} = 1.10$, $t(277) = 2.61$, $p = .046$, $d = 0.67$) or teleiophilic attractions ($M_{diff} = 2.80$, $t(277) = 10.31$, $p < .001$, $d = 1.71$). There was also a significant difference in these attractiveness ratings between teleiophilic and ephebophilic individuals, with the latter group rating prepubescent bodies as more attractive ($M_{diff} = 1.69$, $t(277) = 4.01$, $p < .001$, $d = 1.03$). Pedophilic and hebephilic individuals did not differ in their attractiveness ratings of stimuli depicting prepubescent bodies.

There was a significant interaction between the presented age of the face and participant chronophilia in relation to self-reported attraction to prepubescent female bodies, $F(3, 277) = 38.69$, $p < .001$, $\eta^2_p = 0.29$. For pedophilic ($M_{diff} = 2.05$, $t(277) = 14.43$, $p < .001$, $d_z = 1.34$) and hebephilic participants ($M_{diff} = 0.57$, $t(277) = 3.21$, $p = .032$, $d_z = 0.38$),

prepubescent bodies with child faces were rated significantly more attractive than the same bodies presented in combination with an older (adolescent) face. However, the attractiveness ratings given by ephebophilic (M_{diff} = 0.49, t(277) = 1.40, p = .856, d_z = 0.32) and teleiophilic individuals (M_{diff} = -0.28, t(277) = -1.58, p = .759, d_z = -0.19) were unaffected by manipulating the age of the face.

Pubescent Bodies. We ran a 3 (Face: Child vs. Adolescent vs. Adult; within-subjects) × 4 (Chronophilia: Pedophilia vs. Hebephilia vs. Ephebophilia vs. Teleiophilia; between-subjects) mixed ANOVA on attractiveness ratings for pubescent female bodies. There was no effect of face type on attractiveness ratings, F(2, 554) = 1.97, p = .141, η^2_p = 0.01. However, there was a significant main effect of chronophilia, F(3, 277) = 19.79, p < .001, η^2_p = 0.18. This effect was attributable to significantly lower attractiveness ratings being given by teleiophilic than pedophilic (M_{diff} = -0.67, t(277) = -2.84, p = .025, d = -0.42), hebephilic (M_{diff} = -1.83, t(277) = -7.07, p < .001, d = -1.17), and ephebophilic individuals (M_{diff} = -1.84, t(277) = -4.56, p < .001, d = -1.17). Those with hebephilic (M_{diff} = 1.17, t(277) = 4.99, p < .001, d = 0.75) and ephebophilic attractions (M_{diff} = 1.18, t(277) = 3.03, p = .014, d = 0.75) were also more likely to rate stimuli with pubescent bodies as more attractive than pedophilic individuals. Participants with hebephilic and ephebophilic attractions did not differ in their attraction to pubescent female bodies.

There was a significant interaction between the apparent age of the face and participant chronophilia in relation to attraction to adult bodies, F(6, 554) = 46.45, p < .001, η^2_p = 0.33. For both pedophilic and hebephilic individuals, attraction levels were higher when facial features indicated that the person was younger. Significant differences were observed between pubescent bodies with adult faces and adolescent faces (pedophilic individuals: M_{diff} = 0.68, t(277) = 5.66, p < .001, d_z = 0.53; hebephilic individuals: M_{diff} = 0.81, t(277) = 5.35, p < .001, d_z = 0.63). The difference in attraction levels was again significant for pedophilic

individuals when comparing views of adolescent faces and child faces (M_{diff} = 0.98, t(277) = 8.99, p < .001, d_z = 0.84), but this difference was not statistically significant for participants with hebephilic attractions (M_{diff} = 0.45, t(277) = 3.28, p = .052, d_z = 0.38). Self-reported ephebophiles' self-reported levels of attraction to stimuli with pubescent bodies were unaffected by the facial manipulation. For teleiophilic individuals, attraction levels increased concordantly with the facial age of the person being presented (i.e., older faces elicited more self-reported attraction). There was a significant difference in attraction levels to pubescent bodies when merged with a child's face than an adolescent face (M_{diff} = 0.54, t(277) = 3.94, p = .006, d_z = 0.46), and again a significant difference when the face depicted adulthood (M_{diff} = 1.11, t(277) = 7.35, p < .001, d_z = 0.86).

Adult Bodies. We ran a 2 (Face: Adolescent vs. Adult; within-subjects) × 4 (Chronophilia: Pedophilia vs. Hebephilia vs. Ephebophilia vs. Teleiophilia; between-subjects) mixed ANOVA on self-reported attraction to female stimuli with adult bodies. There was no effect of face type on attractiveness ratings, F(1, 277) = 2.42, p = .121, η^2_p = 0.01. However, there was a significant main effect of chronophilia, F(3, 277) = 15.30, p < .001, η^2_p = 0.14. This effect was driven by significantly lower attractiveness ratings being given by those with pedophilic attractions than self-reported hebephiles (M_{diff} = -1.36, t(277) = -5.49, p < .001, d = -0.82), ephebophiles (M_{diff} = -2.05, t(277) = -4.98, p < .001, d = -1.23), and teleiophiles (M_{diff} = -0.92, t(277) = -1.61, p = .001, d = -0.24). Ephebophilic individuals were more likely to rate stimuli with adult bodies as more attractive than those with teleiophilic attractions (M_{diff} = 1.13, t(277) = 2.64, p = .043, d = 0.68). Hebephilic individuals did not differ in their attraction to merged pictures of people with adult bodies when compared to those with ephebophilic or teleiophilic attractions.

There was a significant interaction between the age of the face depicted in the merged person images and participant chronophilia in relation to attraction to female adult bodies,

$F(3, 277) = 43.63$, $p < .001$, $\eta^2_p = 0.32$. For pedophilic ($M_{diff} = -0.26$, $t(277) = -2.49$, $p = .206$, $d_z = -0.23$), hebephilic ($M_{diff} = -0.39$, $t(277) = -2.99$, $p = .059$, $d_z = -0.35$), and ephebophilic individuals ($M_{diff} = -0.26$, $t(277) = -1.02$, $p = .971$, $d_z = -0.23$), self-reported attraction did not significantly differ as a function of the apparent age of the person (as depicted by the face). However, those with teleiophilic attractions judged stimuli with adult faces to be more attractive than the same bodies when they were accompanied by adolescent faces ($M_{diff} = 1.43$, $t(277) = 10.93$, $p < .001$, $d_z = 1.28$).

General Discussion

In this research, we set out to understand how a chronological age manipulation (i.e., through the manipulation of apparent facial age) influences the judgments of the attractiveness of bodies of different Tanner-related development stages among people with a range of chronophilic orientations. This research was motivated by potential limitations in the use of age-based and Tanner-related cut-offs for determining people's primary chronophilic attraction patterns. After developing a new merged person stimulus set through Studies 1 and 2, we conducted our hypothesis testing in Study 3. Consistent with our expectations, and for the first time within the peer-reviewed literature, we have demonstrated an interaction between a target's apparent age (determined by their facial characteristics) and their physical development (determined by their Tanner staging) in the judgments made about attractiveness by people living in the community with attractions to children.

Overview and Interpretation of Key Results

Consistent with our expectations, we found that prepubescent bodies were generally rated as being more attractive by people with primarily pedophilic or hebephilic attraction patterns than those with primarily ephebophilic and teleiophilic attractions. The reverse was true for judgments of postpubescent (i.e., adult) bodies, with pedophilic and hebephilic

individuals rating these as less attractive (in a general sense) than self-reported ephebophiles and teleiophiles. More nuance was found in attractions to pubescent bodies. Here, those with primarily pedophilic or teleiophilic attractions rated bodies as being less attractive than hebephilic and ephebophilic individuals. This difference may reflect pubescent bodies being perceived as too developed (among those with pedophilic attractions) or under-developed (among those with teleiophilic attractions) for these groups to find them attractive.

However, these main effects were moderated by the manipulation of the apparent age of the person being rated. This is a novel finding that calls into question the reliance on Tanner stages as a method of demarcating chronophilic orientations. That is, it was not simply the development of the body that affected attractiveness ratings, but this in combination with the perceived age of the person (as represented by their facial features). For pedophilic individuals, for example, attractiveness to people with prepubescent bodies was significantly higher when they were accompanied by a child's face than the face of an adolescent. This distinction was not present among those with primarily hebephilic, ephebophilic, or teleiophilic attractions. Setting aside the data for ephebophilic and teleiophilic individuals (we would expect minimal differences in attraction between differently aged pre-pubescent bodies for these groups, given that they are principally indicative of attractions to postpubescence), from these data, we can begin to tease apart the distinctions between chronophilic orientations to younger children. That is, although we find potential evidence for a combined 'pedohebephilia' category in the judgments of prepubescent bodies (for a discussion of the utility of such a combined categorization, see Stephens et al., 2019), it is of theoretical significance that we are able to distinguish between those with primarily pedophilic and hebephilic attractions in their judgments of the attractiveness of such bodies by manipulating the perceived age of the person in an image. Theorizing about the nature of pedo(hebe)philia, then, we might hypothesize that

pedohebephilia (as a combined category) is primarily driven by attractions to prepubescent sexual development, but more specific attributions of childhood (and the associated personality characteristics that accompany these) may be implicated in a purer form of pedophilia. In contrast, those with a purer form of hebephilia may be attracted to prepubescent bodies but be more averse to targets with lower levels of emotional development.

A similar trend appeared for stimuli depicting pubescent bodies. Again, pedophilic (and hebephilic) participants rated these as most attractive when accompanied by a child's face, followed by an adolescent face, and found these bodies least attractive when they were depicted with an adult's face. Among people with ephebophilic attractions the ostensible age of the person in the image (i.e., their facial features) had no statistical bearing on the level of attraction expressed towards pubescent bodies. Among teleiophilic individuals, older facial age was associated with higher levels of attraction. These data are both interesting and significant from a theoretical perspective as they offer the clearest suggestion that the apparent age of an individual (as depicted by their facial features) influence levels of attraction. That is, pubescent bodies in Studies 1 and 2 were associated with the most variable ratings of potential age and physical development, and so the difference in attractiveness ratings as a function of the interaction between participant chronophilia and the apparent age of the target means that it is not the body's physical development that drove attraction, but the inferred age of the person in the picture.

There was a much cleaner pattern in the data with regard to attractions to adult bodies. Among pedophilic and hebephilic individuals (very low levels of attraction) and ephebophilic individuals (moderate levels of attraction), attraction to adult bodies was consistent when such bodies were paired with adolescent or adult faces. In contrast, those with teleiophilic

attractions were more attracted to adult bodies that were presented with an adult face than an adolescent face.

Reflections on Pilot Testing Data

In our rigorous pilot testing of sample merged person images (Studies 1 and 2), we observed substantial variations in the ascription of developmental stages to bodies that were not clearly within Tanner stage 1 (no physical development) and Tanner stage 5 (full physical development). This is a significant observation and one that highlights some of the limitations in using Tanner-related developmental markers when measuring and labelling people's chronophilic orientations. The data coming from our pilot work support our initial motivations for conducting this research, with ambiguity in the recognition of Tanner stages 2-4. This was then associated with substantial variation in levels of self-reported attraction as a function of the stated age of the target in Study 3. In practice, this finding has significant implications for clinical assessment, which commonly uses erectile responses to different Tanner stages as an indicator of potential offense-related sexual arousal patterns (Chivers et al., 2010; McPhail et al., 2019). With our data in mind, there is a potential risk of some individuals being classified as having a chronophilic orientation directed towards children on the basis of their arousal to a particular body type (e.g., being classified as hebephilic due to arousal to Tanner stage 3 bodies) when we know that their attraction to such bodies is contingent on the age of the target. This interaction between the chronological age and physical development of a target is something that clinicians and researchers should explore to ensure that clinical tests properly capture arousal patterns and indicators of potential offense risk.

Limitations and Future Directions

Studies such as those reported here have inherent limitations, not least in that we relied on self-reported data. For example, we were reliant on participants accurately reporting their primary chronophilic orientations, as well as providing subjective self-reported ratings of sexual attractiveness in relation to the images we used. Although objective measures of sexual attraction (e.g., the study of genital arousal) would have been advantageous, there is a balance to be struck in work such as this between the objective assessment of physiological arousal and the need to recruit a sample large enough to give grounds for drawing somewhat generalizable conclusions. Where populations can be accessed, future research may look to replicate our work using such objective measures of attraction to test their robustness using other outcome measures.

In dividing up our sample into chronophilic groups, we asked participants about their dominant attraction status. Although the classification of people into mutually-exclusive chronophilia groups is consistent with other research in this area, we have created groups based on a predominant sexual attraction pattern where non-exclusivity may be present (for research into the non-exclusivity of sexual attractions to children, see Martijn et al., 2020). That is, those who placed themselves as being predominantly pedophilic may also have some attractions to other age categories, only to a lesser degree. Although we have found effects of chronophilia throughout our data, it is possible that controlling for non-exclusivity might reveal more nuanced effects in future work. We did not measure other demographic variables that may have also been associated with different judgments, such as sexual orientation or participant ethnicity. Given the differences in sexual preferences between heterosexual men and women (Buss, 1989), and the well-documented own- and other-race biases in person perception tasks (Hills & Pake, 2015), it is possible that there is unexplained variability in attraction scores as a function of these unmeasured variables. Similarly, we did not ask participants in Study 3 about their age estimates for each image. Although this was a

deliberate decision to not prime perceived age, it may be that some participants had an estimate in mind. Future replications of this work might look to include estimated age as a covariate to establish whether this is linked to differences in attractiveness ratings.

We attempted to mitigate self-presentation biases among people with sexual attractions to children by asking community members who were not (to our knowledge) attracted to children to provide estimates of the ages and physical development of our sources images (Study 1), and, in an independent sample, to rate the realism of our merged people images (Study 2). We also attempted to control for personal sexual preferences by including more than one image per experimental condition in Study 3. This meant that any effects of physical characteristics that were not central to our manipulation (e.g., hair color) were minimized.

Related to the stimuli used, it is an issue inherent in picture sets involving the merging or artificial creation of images that a degree of realism is lost. This was the case in our work (Study 2), with this being consistent with other research using artificial stimuli (see Dombert et al., 2013; Mokros et al., 2013). Future work may be able to address this limitation using emergent artificial intelligence technologies to create photorealistic images. However, alternative methods may include using free stock photos of real people (subject to copyright conditions) and manipulating the stated ages of those depicted in the images. In enacting such a design, researchers must balance the realism of the image with the validity of the experimental manipulation, with pre-test checks of the likely span of ages for each image being conducted. It is also worth noting that we only asked participants to provide age estimates for merged person stimuli in Study 2, which may have primed the to focus on facial features, rather than bodily development. Subsequent validation work in this merged person set might therefore look to control estimates of sexual development in their analyses to establish if this plays a role in attractiveness scores.

Thinking forward about some of our conceptual interpretations, exploring the respective psychologies of pedophilia, hebephilia, and pedophebephilia could be a fruitful avenue for research. In drawing a potential distinction between pedophilia (as perhaps an attraction to youthful personality traits), hebephilia (as an attraction to underdeveloped bodies but more mature emotional development), and pedohebephilia (as a broader category of attraction to physical sexual prepubescence), we might offer some suggestions for studying the psychological nature of these attraction patterns. Merging our data with the work of Martijn et al. (2022), future work might explore the physical and psychological characteristics that are rated as attractive by groups with different chronophilic orientations. In Martijn et al.'s (2022) research, it was noted how pedohebephilic individuals are attracted to a range of physical (e.g., bright eyes, smooth skin) and psychological characteristics (e.g., imagination, lack of preconception). However, the authors did not distinguish between those with a predominant self-reported pedophilic vs. hebephilic attraction. We would predict that psychological traits related to immaturity (e.g., innocence, manipulability) would be ranked as more attractive among people with pedophilic attraction patterns than those who identify themselves as being primarily hebephilic.

Conclusions

The use of age-based cut-offs (Blanchard et al., 2009; Seto, 2017) and the Tanner stages of sexual development (Tanner, 1962) are commonplace in the existing literature on sexual attractions to children for determining the primary chronophilic orientation of people taking part in research in this area. However, neither of these approaches are sufficient in isolation for capturing the nuanced variability of such sexual attractions. In this work, we have shown how the attraction experienced by those with those who are attracted to children is to some extent dependent upon an interaction between perceived age of the children and their physical sexual maturity. This has implications for how we conceptualize and measure

such attractions and encourages us to consider how to best explore the psychological bases for attractions to children. This appears to be particularly the case in relation to delineating pedophilia and hebephilia from the broader pedohebephilia concept that has become increasingly popular within academic discussions (Jahnke et al., 2022; Martijn et al., 2020; McPhail et al., 2018). As such, researchers and clinicians might look to work collaboratively towards unpacking the physical and psychological elicitors of attractions to children to both understand the foundations of such attractions and develop methods for the safe management of attractions to children.

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Table 1. Demographic information (Study 3)

	Sex	**Age**	**Parent**
Full sample	81% male	33.13 years (*SD* = 12.48)	18% yes
Male chronophilia			
Pedophile (*n* = 73)	95% male	34.04 years (*SD* = 11.67)	18% yes
Hebephile (*n* = 62)	92% male	37.51 years (*SD* = 14.67)	13% yes
Ephebophile (*n* = 17)	77% male	31.00 years (*SD* = 11.80)	6% yes
Teleiophile (*n* = 70)	43% male	28.37 years (*SD* = 10.22)	14% yes
Female chronophilia			
Pedophile (*n* = 114)	90% male	34.71 years (*SD* = 12.53)	23% yes
Hebephile (*n* = 72)	89% male	33.58 years (*SD* = 12.96)	21% yes
Ephebophile (*n* = 19)	89% male	28.88 years (*SD* = 8.28)	5% yes
Teleiophile (*n* = 73)	56% male	29.69 years (*SD* = 10.57)	14% yes

Note. 'Male chronophilia' and 'Female chronophilia' refer to participants' self-declared attractions to male and female targets, respectively.

Figure 1a. Examples of male merged person stimuli. Images depict a pubescent body manipulated to have an adult head (left), pubescent head (center), or pre-pubescent head (right).

Figure 1b. Examples of female merged person stimuli. Images depict a pubescent body manipulated to have an adult head (left), pubescent head (center), or pre-pubescent head (right).

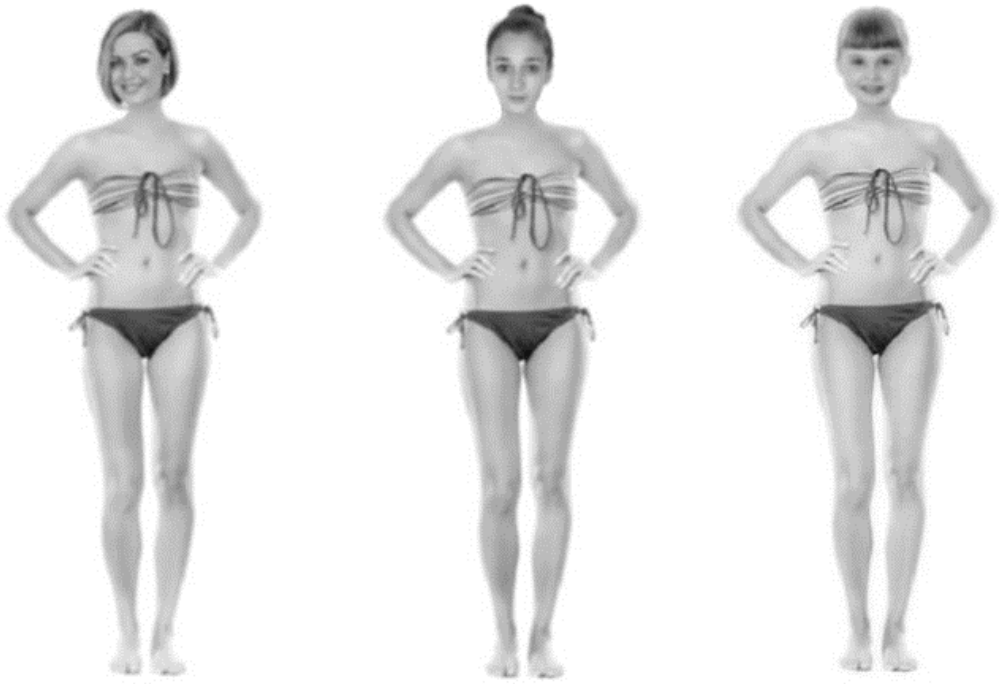

Figure 2a. Attractiveness ratings for male stimuli, by participant chronophilia and face/body configuration. Error bars represent ±1 *SE*.

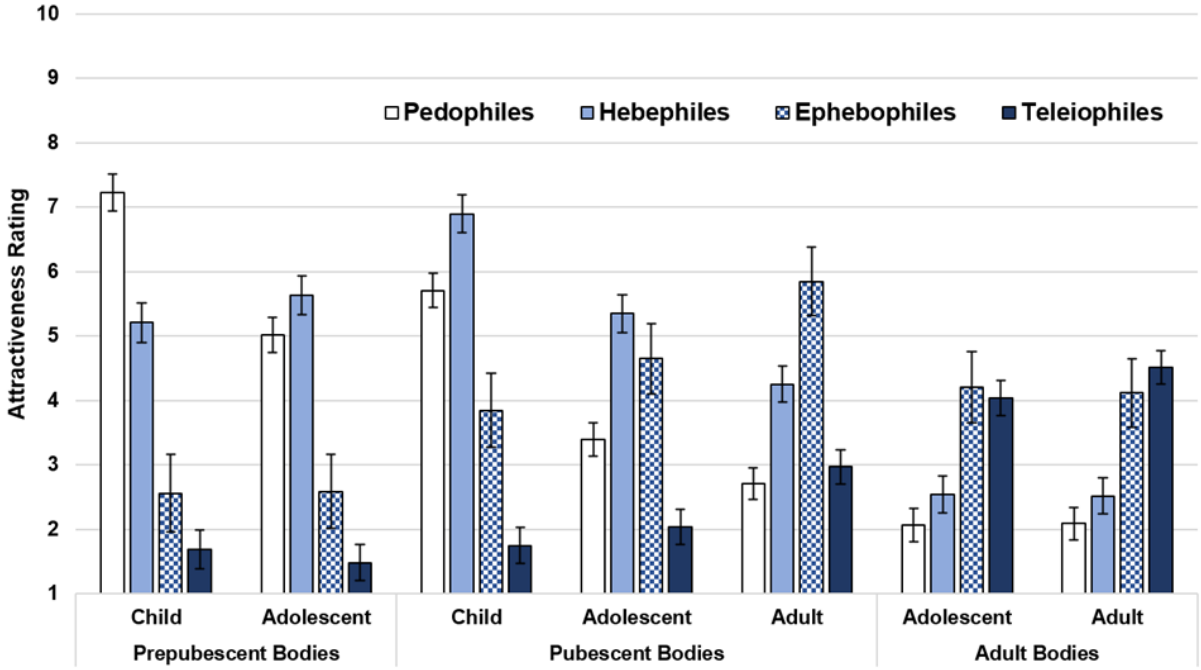

Figure 2b. Attractiveness ratings for female stimuli, by participant chronophilia and face/body configuration. Error bars represent ±1 *SE*.