**Introduction**

*Paragraph 1 – sex differences – sexual selection*

That males often have greater variability than females is a trend observed across the animal kingdom for a range of behavioural, physiological and morphological traits. For humans, male-biased sex differences in variability have been reported for traits like intelligence (Halpern & LaMay 2000; Arden & Plomin 2006; Johnson *et al*. 2008), birth weights and several blood parameters (Lehre *et al*. 2008), creativity (Ju *et al.* 2015; Karwowski *et al*. 2016) and in personality traits related to intrasexual competition (i.e. aggression; Budaev 1999; Archer & Mehdikhani 2003). Yet the origins of sex-biased variation remain under debate (references?). Darwin (1871) was the first to suggest that males might be the more variable sex because males are frequently the sex under sexual selection. Therefore, traits important for male fitness should have increased variance, compared to the same traits in females or other non-sexually selected traits, in order for sexual selection to operate (Pomiankowski & Møller 1995, Wyman & Rowe 2014). *This is true for sexually-selected traits*

* The ‘greater male variability’ hypothesis suggests that males are more variable than females across a range of behavioural and morphological traits (Pomiankowski & Møller 1995). *Talk about this in here because it is more broad and kind of encompasses sexual selection*

*Paragraph 2 – sex differences – shared traits, sex chromosome hypothesis*

*For shared traits:* One proposed explanation for observed greater male variation is the ‘sex chromosome’ hypothesis (James 1973; other reference?). Generally, females have two copies of the X chromosome (homogamety), so the effects of any genes found on the X chromosome become averaged out, either through epigenetic inactivation of some regions during development (Amos-Landgraf *et al*. 2006), or through mosaicism where the ratio of genes on either X chromosome copy are variably expressed (Lyon 1961). Males, however, only have one copy of the X chromosome (heterogamety), so all genes present on their copy of the X chromosome are fully expressed, leading to more extreme phenotypes and, consequently, higher variances for shared traits. If sex chromosomal arrangement is responsible for greater variability in one sex, we might then expect species where females are the heterogametic sex to express greater variability in shared traits than males. In a meta-analysis covering a broad range of taxonomic groups, Reinhold & Engqvist (2013) found that species with heterogametic males, males had greater variability in body size than did females, and in species with heterogametic females, females had greater variability in body size than males. *This is too general, need to be specific that males aren’t always the homogametic sex*

* *Talk about SSD in here and how sexual size dimorphism can potentially explain sex differences…*
* Additionally, condition-dependent expression of traits under sexual selection, where environmental effects beyond heritable genetic effects, can increase trait variability
  + Such as SSD
* When we look at the benefits of each trait in an evolutionary context, most seem to benefit males (i.e. more partners, better mating success, more attractive to females)
* So it might then be reasonable to assume that males are the more variable sex when it comes to personality…

*Paragraph 3 – personalities and sex differences*

* *Trade-offs with personalities (costs and benefits to scoring high or low on each of the five factor traits) in a human context*
* Need to talk about animal personalities, what they cover – can relate back to humans here to make it easier to understand
* behavioural traits, like personality, might benefit male mating success, are personality traits under sexual selection? Would we see one sex having greater variability in personality than the opposite sex?
* Ecologists and psychologists alike have reasoned that personality traits, for males, might confer mating benefits depending on female preferences, frequency-dependence and environmental conditions. For example,

Paragraph 4 – what we did and why (aims and meta-analysis overview)

*Something here about human personalities and obvious sex differences, and experimental evidence that males might be more variable than females in animals, but do these trends hold across broad taxonomic groups? And if so, what mechanisms might underlie sex differences in shared behaviours?*

* Talk about the Tarka paper in here, how we plan to expand on their findings by focusing on personality traits only …
* Hypothesis testing for variability:
  1. Greater male variability – males will be more variable than females overall and for each personality trait (aims 1 & 2)
  2. Sex chromosome hypothesis – males will be more variable than females, especially in taxonomic groups with homogametic males – for which SSD is a good proxy (aims 1, 2 & 3)
  3. Sexual selection – males will be more variable than females especially for traits related to male reproduction and for species with male-biased SSD (a good proxy for sexual selection) (aims 2 and 3)
* Hypothesis testing for mean difference:
  1. Males and females might share similar means, like several human personality trait studies, except for personality traits that reflect different sex roles (i.e. female-biased dispersal, territoriality, parental care, mating system)
* We have 3 main aims which we used to form our 3 main meta-analytic models:
  1. Do males and females differ in either their central tendency or variability in personality-like behaviours overall?
  2. Are there sex differences in mean or variability for the different personality trait types?
  3. Does the degree of sexual size dimorphism explain sex differences in mean or variability?