

## Testosterone & gift-giving: Mating confidence moderates the association between digit ratios (2D:4D and *rel2*) and erotic gift-giving



Marcelo Vinhal Nepomuceno<sup>a,\*</sup>, Gad Saad<sup>b</sup>, Eric Stenstrom<sup>c</sup>, Zack Mendenhall<sup>d</sup>, Fabio Iglesias<sup>e</sup>

<sup>a</sup> Department of Marketing, HEC Montréal, 3000, Chemin de la Côte-Sainte-Catherine, Montréal, QC H3T 2A7, Canada

<sup>b</sup> Department of Marketing, John Molson School of Business, Concordia University, 1455 de Maisonneuve West, Montreal, QC H3G 1M8, Canada

<sup>c</sup> Marketing Department, Farmer School of Business, Miami University, Oxford, OH 45056, United States

<sup>d</sup> Desautels Faculty of Management, Department of Marketing, McGill University, Bronfman Building, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada

<sup>e</sup> Laboratório de Psicologia Social, Campus Universitário Darcy Ribeiro, Ala Sul do Instituto Central de Ciências, Universidade de Brasília, Sala A1-120, Asa Norte, 70900-100 Brasília, DF, Brazil

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### ABSTRACT

While prenatal testosterone and estrogen have been associated with various masculinized traits such as risk-taking, aggression, athletic ability, and sex drive, little is known regarding the impact of prenatal hormones on male romantic gift-giving. In a sample of 130 Caucasian men, we investigate the association between digit ratios (2D:4D and *rel2*), a proxy of exposure to prenatal testosterone-to-estrogen ratio, and the likelihood of offering erotic gifts to romantic partners. We hypothesize that men with highly masculinized (low) digit ratios and high mating confidence (i.e., the self-perceived ease with which one gains sexual access to others) will engage in greater erotic gift-giving. We find that masculinized digit ratios are associated with greater erotic gift-giving, but only among men with high mating confidence. Our findings suggest that high prenatal testosterone exposure and high prenatal estrogen exposure are likely to promote a greater desire to offer erotic gifts to a romantic partner, but that only men with high mating confidence have the courage to act on these desires.

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### 1. Introduction

Gift-giving plays important social roles by promoting cooperation and trust (Carmichael & Macleod, 1997), celebrating special occasions, and expressing caring feelings (Belk, 2005; Goodwin, Smith, & Spiggle, 1990). In romantic relationships, gifts are used as a courtship tactic to signal amorous intent and commitment (Saad, 2007, 2011; Saad & Gill, 2003). An estimated 17.6 billion dollars are spent on Valentine's Day in the US alone (National Retail Federation, 2012). Thus, developing a greater understanding of the drivers of amorous gift-giving has important practical implications.

In the current research, we investigate a particular type of gift-giving that occurs during a romantic relationship, namely erotic gift-giving (i.e., lingerie and erotic products). These gifts also represent a substantial industry, given that lingerie stores have annual revenues of 13 billion dollars in the US alone (IBISWorld, 2014). While there are several studies examining the impact of erotic content on cognition (Wright &

Adams, 1999), emotions (Herrell, 1975), brand recall (Weller, Roberts, & Neuhaus, 1979), and attitudes towards ads (Dahl, Sengupta, & Vohs, 2009; Sengupta & Dahl, 2008), there has been no research thus far investigating erotic gift-giving.

We take a physiological approach by exploring the relationship between erotic gift-giving and hormones. In particular, we examine how erotic gift-giving is associated with digit ratio, an indicator of prenatal exposure to testosterone and estrogen (Lutchmaya, Baron-Cohen, Raggatt, Knickmeyer, & Manning, 2004; Manning, Scutt, Wilson, & Lewis-Jones, 1998; Manning et al., 2003). The most common measure of digit ratio is 2D:4D, which is the ratio of the length of the index finger (2D) in comparison to the length of the ring finger (4D). Individuals with masculinized (i.e., low) digit ratios were exposed to a high testosterone-to-estrogen ratio, whereas individuals with feminized (i.e., high) digit ratios were exposed to a low testosterone-to-estrogen ratio (Manning et al., 1998). The goal of the current study is to investigate the influence of prenatal testosterone and estrogen on consumer behavior by exploring the association between digit ratios and erotic gift-giving in men.

### 2. Literature review

Testosterone is a masculinizing hormone that has both real-time activational effects on behavior as well as long-term organizational

\* Corresponding author.

E-mail addresses: [marcelo.nepomuceno@hec.ca](mailto:marcelo.nepomuceno@hec.ca) (M.V. Nepomuceno), [gadsaad@jmsb.concordia.ca](mailto:gadsaad@jmsb.concordia.ca) (G. Saad), [stenstep@miamioh.edu](mailto:stenstep@miamioh.edu) (E. Stenstrom), [zachary.mendenhall@mail.mcgill.ca](mailto:zachary.mendenhall@mail.mcgill.ca) (Z. Mendenhall), [iglesias@unb.br](mailto:iglesias@unb.br), [fabiglesias@gmail.com](mailto:fabiglesias@gmail.com) (F. Iglesias).

effects during developmentally important stages (e.g., prenatal and pubertal) on the brain, body, and future behavior (Archer, 2006; Hines, 2006; Rey & Picard, 1998). In contrast, prenatal estrogen is a feminizing hormone that has cyclical effects on behavior and cognition in women (Grammer, Renninger, & Fischer, 2004; Rosenberg & Park, 2002; Toffoletto, Lanzenberger, Gingnell, Sundström-Poromaa, & Comasco, 2014) and organizational effects on the brain in utero in both sexes (Bakker & Baum, 2008; Manning, 2002; McCarthy, 2008). In the current paper, we focus on the long-term organizational effects of prenatal testosterone and prenatal estrogen by examining the association between digit ratios and erotic gift-giving.

Digit ratios are a sexually dimorphic trait, with male ratios tending to be more masculinized (i.e., lower) than female ratios (Manning et al., 1998). There is a growing body of research indicating that masculine digit ratios (indicative of a greater prenatal testosterone-to-estrogen ratio) in men are associated with typically masculine traits such as aggression (Bailey & Hurd, 2005; Hönekopp, 2011; McIntyre et al., 2007; Ronay & Galinsky, 2011), dominance (Manning & Fink, 2008; Neave et al., 2003), and athletic ability (Hsu et al., 2015; Longman, Stock, & Wells, 2011; Manning & Hill, 2009; Manning, Morris & Caswell, 2007; Manning & Taylor, 2001). Further, masculine digit ratios in men are associated with higher sex drive (Manning & Fink, 2008), number of sexual partners (Hönekopp, Voracek, & Manning, 2006), and number of offspring (Manning & Fink, 2008; Manning, Henzi, Venkatramana, Martin & Singh, 2003; Manning et al., 2000). Overall, the digit ratio literature suggests that exposure to a high prenatal testosterone-to-estrogen ratio leads to more masculinized traits and higher sex drive in men.

Few studies have directly investigated the association between digit ratios and consumer behavior. Masculine digit ratios have been associated to greater trading success in financial markets (Coates, Gurnell, & Rustichini, 2009), greater value of current financial resources (Millet & Dewitte, 2008) and greater financial risk-taking (Coates & Page, 2009; Evans & Hampson, 2014; Stenstrom, Saad, Nepomuceno, & Mendenhall, 2011). Masculine digit ratios have also been linked to greater recreational risk-taking such as skydiving and bungee jumping (Stenstrom et al., 2011). Aspara and Van Den Bergh (2014) found that men with masculinized digit ratios are more likely to prefer masculine products (i.e., regular coke) and masculine colors (i.e., dark and cold colors), whereas men with feminized digit ratios are more likely to prefer feminine products (i.e., diet coke) and feminine colors (i.e., light warm colors). Thus, the research suggests that exposure to a higher prenatal testosterone-to-estrogen ratio is associated with greater financial and recreational risk-taking, and with greater preferences for masculine products.

Building on the research showing that sex drive is associated with masculinized digit ratios in men (Manning & Fink, 2008), Nepomuceno, Saad, Stenstrom, Mendenhall, and Iglesias (in press) documented that men with masculinized digit ratios are more inclined to engage in courtship-related consumption to woo potential mates and retain current mates. Furthermore, Huh (2011) found that men with masculinized digit ratios have stronger preferences for watching erotic videos. In the current work, we hope to extend this line of research by investigating if digit ratios are associated with erotic gift-giving in a romantic relationship. Given that exposure to a high prenatal testosterone-to-estrogen ratio in men leads to a higher sex drive (Manning & Fink, 2008) and that testosterone promotes mating effort (Archer, 2006), we expect that masculine digit ratios in men will be associated with greater erotic gift-giving in a romantic relationship. However, since sex-related products can lead to feelings of embarrassment (Dahl, Manchanda, & Argo, 2001), erotic gift-giving should require a high level of mating confidence, which is defined as the self-perceived ease with which one gets sexual access to others (Landolt, Lalumiere, & Quinsey, 1995). Therefore, we expect that exposure to high prenatal testosterone-to-estrogen ratio will lead to a greater desire to give erotic gifts, but only men with both a high prenatal testosterone-to-estrogen

ratio and high mating confidence will have the courage to give erotic gifts to their romantic partner. In support of this rationale, Nepomuceno et al. (in press) found that the association between masculinized digit ratios and courtship-related consumption was stronger for men with high mating confidence. Since the courtship behaviors that men typically engage in tend to be bold in nature (e.g., buying dinners at nice restaurants), men with masculinized digit ratios and with high mating confidence were more inclined to engage in consumption to attract mates. Considering that offering erotic gifts can be embarrassing and should require a high level of confidence, we hypothesize that masculine digit ratios will be associated with greater erotic gift-giving, but only among men with high mating confidence.

### 3. Study

#### 3.1. Study design, sample, and procedure

Our sample was composed of 242 students from a Brazilian university. Prior research has demonstrated that digit ratios vary considerably by ethnicity (Fink, Thanzami, Seydel, & Manning, 2006; Manning, Churchill, & Peters, 2007; Manning & Fink, 2008). Thus, the standard when samples are highly ethnically heterogeneous is to control for ethnicity by analyzing subgroups of ethnically homogeneous participants (Manning & Fink, 2008; Manning, Fink, & Trivers, 2014; Peters, Manning, & Reimers, 2007; Stenstrom et al., 2011). We emulate prior research by conducting the analyses in subgroups of ethnically homogeneous participants whose sample sizes are large enough to permit it. We asked participants to indicate the country or region where their ancestors are originally from. We used this method because self-report of ethnicity is an unreliable measure of ethnicity in highly ethnically heterogeneous countries such as Brazil (Parra et al., 2003). Prior research found that Brazilians who self-reported as black had a large proportion of non-African ancestry (48%), whereas Brazilians who self-reported as Caucasian had a strong presence of Amerindian (33%) and African (28%) ancestry (Parra et al., 2003). Given that self-reports of ethnicity tend to be unreliable in Brazil, we used self-reports of ancestry to identify ethnicity. One hundred and thirty-six participants indicated that their ancestors were from European countries where the majority of the population is Caucasian. We used this Caucasian subsample in our analyses because it was the largest ethnically homogeneous subsample. The remaining ethnically homogeneous subsamples did not have sample sizes large enough to conduct meaningful analyses ( $n < 7$ ). From the pool of 136 participants, we removed six participants who have had broken their fingers in the past. This resulted in a final sample of 130 Caucasians males. The average age of participants was 20.12 years ( $SD = 2.44$ ).

Participants completed the questionnaires on a university campus, in or out of classrooms. We measured erotic gift-giving by asking participants to indicate “the likelihood of giving each of the following gifts to your girlfriend, using a scale from 1 to 7 (1 = “not likely at all” to 7 = “extremely likely”). The gifts in question were erotic undergarments (lingerie) and erotic products ( $\alpha = .65$ ). We assessed mating confidence via Landolt et al.’s (1995) self-perceived mating success scale (6 items,  $\alpha = .80$ ). Examples of items used in this scale include “members of the opposite sex notice me” and “I can have as many sexual partners as I choose.” In addition, we included demographic questions and items that fall outside the scope of the current manuscript.

#### 3.2. Digit ratio measures

Typically, previous digit ratio studies have used 2D:4D as an indicator of exposure to prenatal testosterone and estrogen. However, other measures of digit ratio have been tested. Loehlin, Medland, and Martin (2009) found that the length of the four digits, relative to the second digit (named as *rel2*), performed better than 2D:4D when

differentiating between females and males. Further, [Stenstrom et al. \(2011\)](#) obtained somewhat stronger effects regarding men's risk-taking proclivities when *rel2* was used than when 2D:4D was used. Given that in some studies, *rel2* has outperformed or performed as well as 2D:4D, we included measurements of both *rel2* and 2D:4D.

Given that digit ratios typically lead to greater sex differences when measuring fingers on the right hand than those on the left hand ([Loehlin et al., 2009](#); [Voracek, Tran, & Dressler, 2010](#)), trained experimenters measured participants' right-hand fingers using digital calipers at the end of the survey. We obtained a separate sample of 21 participants to determine the inter-experimenter and intra-experimenter reliabilities. [Table 1](#) presents the intraclass correlation coefficients (ICC), which are within the values obtained by previous digit ratio studies ([Voracek, Manning, & Dressler, 2007](#)).

### 3.3. Results

We tested our hypothesis by conducting the analyses on the male Caucasian sample ( $n = 130$ ). We ran multiple regression analyses with *rel2* or 2D:4D as the independent variable, mating confidence as the moderator, and erotic gift-giving as the dependent variable. To include the interaction between *rel2* (or 2D:4D) and mating confidence, we first centered the variables and then multiplied together. We found a significant interaction between mating confidence and *rel2* on erotic gift-giving ( $\beta = -.29, t = -3.300, p = .001$ ) and a significant interaction between mating confidence and 2D:4D on erotic gift-giving ( $\beta = -.27, t = -3.143, p = .002$ ). In support of our hypothesis, *rel2* and erotic gift-giving correlated negatively when mating confidence was high ( $SD = 1$ ; see [Fig. 1](#)). In addition, *rel2* and erotic gift-giving were positively correlated when mating confidence was low ( $SD = -1$ ). Similarly, 2D:4D and erotic gift-giving correlated negatively when mating confidence was high, and positively when mating confidence was low. Of note, mating confidence correlated positively with erotic gift-giving when *rel2* was used in the analysis ( $\beta = .22, t = 2.551, p = .01$ ) and when 2D:4D was used in the analysis ( $\beta = .21, t = 2.390, p = .02$ ). Furthermore, *rel2* and 2D:4D did not directly correlate with erotic gift-giving ( $p^{rel2} = .86; p^{2D:4D} = .61$ ), nor did they correlate with mating confidence ( $p^{rel2} = .52; p^{2D:4D} = .86$ ). Overall, we obtained slightly stronger results when *rel2* was used instead of 2D:4D, such that the adjusted  $R^2$  was larger with *rel2* than with 2D:4D (.088 vs. .082).

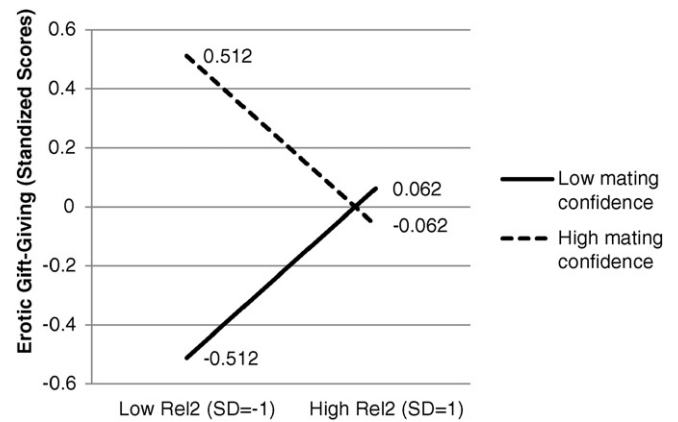
### 4. Conclusion

We found that masculinized digit ratios were associated with erotic gift-giving, but only among men with high mating confidence. This finding constitutes a significant theoretical contribution by suggesting that prenatal testosterone and estrogen not only influence sex drive ([Manning & Fink, 2008](#)), romantic gift-giving ([Nepomuceno et al., in press](#)) and preferences for erotic videos ([Huh, 2011](#)), but also has an impact on erotic gift-giving among men with high mating confidence. While exposure to high prenatal testosterone and low prenatal estrogen are likely to promote a greater desire to offer erotic gifts in men, only those with high mating confidence are able to act on these bold desires. Given that trait variables are rarely investigated as moderators in hormonal research, our findings highlight the value of examining in future research how trait variables interact with digit ratios.

**Table 1**

Intra-experimenter and inter-experimenter intraclass correlation coefficients.

		<i>rel2</i>	2D:4D
Intra-experimenter ICC	Experimenter 1	.967	.975
	Experimenter 2	.840	.830
Inter-experimenter ICC	Trial a	.885	.835
	Trial b	.867	.886



**Fig. 1.** Interaction of *rel2* and mating confidence on sexual gift giving.

Surprisingly, we found that men with low mating confidence and masculinized digit ratios were less likely to offer erotic gifts than their feminized counterparts. A potential post-hoc explanation is that men with masculinized digit ratios and low mating confidence have had greater erotic gift-giving failures, which might have led to a more negative view regarding erotic gift-giving. Given that men with masculinized digit ratios have a higher sex drive than men with feminized digit ratios ([Manning & Fink, 2008](#)), they might have stronger desires to offer erotic gifts, and have probably acted more often on these desires in the past than men with feminized digit ratios. However, men with masculinized digit ratios and low mating confidence are probably more likely to have had negative outcomes from erotic gift-giving in the past than men with feminized digit ratios and low mating confidence (they tried more and therefore failed more), and these negative romantic experiences might lead to lesser current erotic gift-giving. In other words, men with masculinized digit ratios and low mating confidence might have tried to engage in greater erotic gift-giving in the past more than their feminized counterparts, which might have led to more negative outcomes, which in turn might have led to lesser current erotic gift-giving. However, this explanation is speculative and it warrants future research.

There are distinct ways by which one might study the associations between morphological features and phenomena within social and business contexts. Numerous studies have documented links between one's appearance (e.g., attractiveness, height, facial features) and occupational success (see [Little & Roberts, 2012](#) for relevant references). In other instances, people's morphological features, such as facial structure, have been correlated to their likelihood to engage in specific behaviors including athletic aggression ([Carré & McCormick, 2008](#)) and unethical acts ([Haselhuhn & Wong, 2012](#)). Of the few marketing relevant studies that have investigated morphological features, [Windhager et al. \(2008\)](#) examined how individuals use the morphology of a car front to attribute it human qualities (e.g., personality traits, emotions), while [Saad and Gill \(2014\)](#) demonstrated that a man's perceived height (a morphological feature) was dependent on the car to which he was associated. When a male target was associated with a high-status car, male participants shortened his perceived height (a form of intra-sexual denigration) whilst female participants augmented it (male height is a desired attribute that is linked to higher status). The current work contributes to this nascent area at the nexus of morphology and consumer behavior, an area ripe for future research possibilities. From a practical perspective, morphological features might be used for segmentation purposes. Not unlike how personality traits are used to segment markets according to usage patterns, consumers' morphologies might predict specific consumer choices (e.g., male consumers with masculinized morphological features might be more likely to purchase "muscle" cars).

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