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ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/plat20

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To cite this article: Paul Rodway, Volker Thoma & Astrid Schepman (2022) The effects of sex and handedness on masturbation laterality and other lateralized motor behaviours, Laterality, 27:3, 324-352, DOI: 10.1080/1357650X.2021.2006211

To link to this article: https://doi.org/10.1080/1357650X.2021.2006211

Published online: 26 Nov 2021.

LATERALITY: ASYMMETRIES OF BRAIN, BEHAVIOUR, AND COGNITION
2022, VOL. 27, NO. 3, 324–352
https://doi.org/10.1080/1357650X.2021.2006211

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The effects of sex and handedness on masturbation laterality and other lateralized motor behaviours

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ABSTRACT

Masturbation is a common human behaviour. Compared to other unimanual behaviours it has unique properties, including increased sexual and emotional arousal, and privacy. Self-reported hand preference for masturbation was examined in 104 left-handed and 103 right-handed women, and 100 left-handed and 99 right-handed men. Handedness (modified Edinburgh Handedness Inventory, EHI), footedness, eyedness, and cheek kissing preferences were also measured. Seventy nine percent used their dominant hand (always/usually) for masturbation, but left-handers (71.5%) were less consistently lateralized to use their dominant hand than right-handers (86.5%). Hand preference for masturbation correlated more strongly with handedness (EHI), than with footedness, eyedness, or cheek preference. There was no difference in masturbation frequency between left- and right-handers, but men masturbated more frequently than women, and more women (75%) than men (33%) masturbated with sex aids. For kissing the preferred cheek of an emotionally close person from the viewer's perspective, left-handers showed a left-cheek preference, and right-handers a weaker right-cheek preference. The results suggest that hemispheric asymmetries in emotion do not influence hand preference for masturbation but may promote a leftward shift in cheek kissing. In all, masturbation is lateralized in a similar way to other manual motor behaviours in left-handed and right-handed men and women.

ARTICLE HISTORY Received 22 May 2021; Accepted 10 November 2021

KEYWORDS Vibrator; head-tilt; stimulation; genitals; health

Introduction

Humans are strongly lateralized for motor tasks, with approximately 90% of people preferring to use their right hand for most manual motor behaviours

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Supplemental data for this article can be accessed https://doi.org/10.1080/1357650X.2021.2006211

(Cashmore, Uomini, & Chapelain, 2008; Elias, Bryden, & Bulman-Fleming, 1998; Frayer et al., 2012; McManus, 2019; Papadatou-Pastou, et al., 2020). In contrast, other species have a more even preference in hand use, though individuals within a species can show consistent hand preferences (Díaz, Murray, Roberts, & Rodway, 2021; McManus, 2019). Some research has also shown population level right-hand preferences in primates for specific forms of tool use (Hopkins, 1995), but this does not match the degree of hand preference found in humans (Frayer, et al., 2012; Uomini, 2009).

Differences in brain functioning are evident when humans use their preferred versus non-preferred hand (Tzourio-Mazoyer, et al., 2021) with each hand controlled by regions in the contralateral hemisphere (Rice, Tunik, Cross, & Grafton, 2007). It remains unclear, however, why humans as a species are so strongly right-handed and several theories have been proposed (Marcori & Okazaki, 2020; McManus, 2019), including the view that it is related to the development of language in the left hemisphere (Corballis, 2015). The presence of lateralized motor behaviour in most other species (Güntürkün, Ströckens, & Ocklenburg, 2020; Rogers, 2017) could indicate that it evolved because it conveys advantages for a variety of behaviours, with each hand preference providing different fitness benefits (Frayer et al., 2012; Groothuis, McManus, Schaafsma, & Geuze, 2013; Petit et al., 2015; Zickert, Geuze, van der Feen, & Groothuis, 2018), which results in a stable minority of left-handers in human populations (Groothuis, Zickert, Riedstra, & Geuze, 2021; Vallortigara, 2006).

A motor behaviour that most humans exhibit is self-manipulation of the genitalia, or masturbation (Leitenberg, Detzer & Srebnik, 1993). Masturbation has been studied extensively in humans (Clifford, 1978; Leff & Israel, 1983; Regnerus, Price & Gordon, 2017), may have health benefits (Levin, 2007), and is part of the behavioural repertoire of many species (Dubuc, Coyne & Maestripieri, 2013; Inoue, 2012), including most nonhuman primates (Thomsen & Sommer, 2015). A frequently reported lay belief is that males are more likely to use their left hand to masturbate, so that it will "feel like someone else" masturbating them. However, lateralized hand use for masturbation in humans has not been systematically studied, despite this behaviour having a number of unique properties that make it of interest to laterality research. This study aims to fill the gap in the literature.

Most individuals use their dominant hand for unimanual tasks and it can be expected that a similar pattern of hand preference will occur for masturbation. A further potential influence, however, is a hemispheric asymmetry in emotional processing. A distinct feature of masturbation, compared to many other motor behaviours, is that it involves feelings of sexual arousal, a component of which can include strong feelings of emotion and pleasure (Walter et al., 2008). Research indicates that the right hemisphere is more involved than the left hemisphere in sexual arousal (Cohen, Rosen, & Goldstein,

1985; Stoléru et al., 1999; Tucker and Dawson, 1984), and possibly orgasm (Suffren, et al., 2011). Evidence also suggests that the hemispheres are asymmetrically specialized for processing emotions (Borod, 1993; Gainotti, 2020). As emotional and motor neural networks may interconnect in a hemisphere, greater involvement of emotional systems in one hemisphere may bias motor behaviour towards activity controlled by that hemisphere (Ocklenburg et al., 2018; see also Kinsbourne's 1970 hemispheric activation theory).

Evidence in support of this suggestion comes from studies which have shown that emotional context, in addition to handedness, influences the expression of lateralized motor behaviour. This has been shown most clearly in the realm of social touch (e.g., cradling, embracing, and kissing) which are motor behaviours that often involve an emotional connection between individuals (Barrett, Greenwood & McCullagh, 2006; Güntürkün, 2003; Lucas, Turnbull, & Kaplan-Solms, 1993; Ocklenburg et al., 2018; Sedgewick, Holtslander, & Elias, 2019; Turnbull & Lucas, 1996; Turnbull, Stein, & Lucas, 1995; van der Meer & Husby, 2006). For example, people have a tendency to tilt their head rightwards when kissing romantically, whereas parental kissing results in a tendency to tilt the head leftwards (Sedgewick, & Elias, 2016). This head tilt bias is also influenced by handedness, with people who are right-lateralized kissing toward the right and those who are left-lateralized kissing toward the left (Karim, et al., 2017; Ocklenburg & Güntürkün 2009; but see van der Kamp & Canal-Bruland, 2011). Similarly, for embracing, there is a bias for right-side embraces which reflect handedness (Packheiser et al., 2019; Turnbull et al., 1995), which is also influenced by emotional context, with emotional embraces, but not neutral embraces, causing a shift to left-side embraces (Packheiser et al., 2019). Ocklenburg et al., (2018) concluded that asymmetries in social touch are influenced by handedness and the emotive content of the behaviour. This influence of emotion even extends to posing for a portrait, with posing for a family portrait to display as much real emotion as possible resulting in a tendency to show the left cheek, but posing impassively, without emotion, resulting in a tendency to show the right cheek (Nicholls, Clode, Wood, & Wood, 1999). Therefore, the influence of emotional context on lateralized motor biases in social touch and portrait posing suggest that emotional and sexual arousal during masturbation could also influence which hand is preferred.

Competing predictions of how emotion might shift hand preference for masturbation can be derived from different theories of emotional lateralization. The right hemisphere hypothesis, for which there is substantial evidence, suggests that the right hemisphere (RH) is more specialized than the left hemisphere (LH) for all forms of emotional processing (for a recent review see Gainotti, 2020). Therefore, increased activation of the RH, during sexual and emotional arousal of masturbation, could bias motor behaviour toward greater use of the left hand in both right-handed and left-handed

individuals, relative to the frequency with which they use their left hand for other tasks. An alternative prediction can be derived from the valence hypothesis of emotional asymmetries. Although evidence indicates that the RH is more involved in sexual arousal and orgasm (Cohen et al., 1985; Suffren, et al., 2011), which are typically regarded as positive experiences, the valence hypothesis suggests the LH is more specialized for positive emotions and the RH for negative emotions (Ahern & Schwartz, 1985; Davidson & Fox, 1982; Rodway, Wright, & Hardie, 2003). If the valence hypothesis is correct, with positive emotions experienced during masturbation causing greater LH involvement, then there could be a shift towards increased use of the right hand for masturbation, in both right-handed and left-handed individuals, relative to the frequency with which they use their right hand for other tasks. On balance, however, as the evidence appears to be stronger for the right hemisphere hypothesis (Gainotti, 2020), and the RH appears more specialized for sexual and emotional arousal, we expected that any shift in hand use for masturbation would be to use the left hand more frequently. This would be in accordance with the RH hypothesis of emotional involvement.

A further unique property of masturbation, in comparison to other forms of motor behaviour, is that the motor action of masturbation can be expected to differ more between the sexes, due to the different anatomy of the male and female genitalia. Female masturbation techniques tend to involve direct or indirect stimulation of the clitoris, with the majority of women using one or more fingers involving rhythmic strokes and movements of varying length, intensity and pressure (Clifford, 1978). A substantial proportion of women (52.5%) now use a vibrator during masturbation (Herbenick, et al., 2009), though it is unclear which hand they use to hold the vibrator. Conversely, male masturbation usually consists of holding the penis with the hand and moving the foreskin up and down the shaft and over the glans penis. A similar hand action is typically used by circumcised men though sometimes with the use a lubricant to aid the movement (Milos & Macris, 1994). Given the difference between the genitalia of the sexes and the movements involved, it is possible that masturbation in women requires more fine motor control than in men. For fine motor tasks, humans (Mathew et al. 2019; Peters, 1980, 1998; Steenhuis & Bryden, 1989) and animals (Uomini, 2009) may be more likely to use their dominant hand (but see Bryden, Pryde, & Roy, 2000; Hausmann, Kirk, & Corballis, 2004), which could therefore predispose women to use their dominant hand for masturbation more frequently than men.

Research on handedness and motor skill has also found that left-handers are more skilled with their non-dominant hand compared to right-handers (Judge & Stirling, 2003). In general, left-handers are also less strongly lateralized for motor tasks than are right-handers (McManus, Van Horn & Bryden,

2016; McManus, 2019), with left-handers tending to use their non-dominant hand more frequently (Bryden, et al., 2000). This suggests that left-handers will be more able and more likely to use their non-dominant hand while masturbating compared to right-handers, as they do for other forms of motor behaviour.

While it is unclear how strongly the environment influences handedness (McManus, 2021), evidence indicates that cultural (Raymond & Pontier, 2004) and environmental factors (Ocklenburg, et al., 2010) can influence the degree of handedness. These can include prior learning from using devices designed for right-handed people (Elias et al. 1998). Relative to other motor behaviours, however, masturbation is a much more private behaviour (Kirschbaum & Peterson, 2018) and may be less subject to direct influence from environmental factors, or learning from others, potentially making it a relatively pure measure of hand preference. This is not to say that environment and prior learning will not have an influence, but that hand preference for masturbation might be less contaminated by these factors than are other forms of motor behaviour. If this is the case, hand preference for masturbation might correlate strongly with other reliable measures of handedness and show a high level of preference for the dominant hand.

In summary, a number of hypotheses regarding hand preference for masturbation can be proposed. First, it can be hypothesized that hand preference for masturbation is strongly determined by hand dominance like other unimanual motor behaviours, and this line of thinking leads to a hypothesis of significant preferences for the use of the dominant hand (H1). Secondly, if hand preference for masturbation is a purer measure of handedness, uninfluenced by environmental factors, then it should be significantly more lateralized than other motor behaviours as measured by the modified Edinburgh Handedness Inventory (H2). Third, based on past research, it was hypothesized that left-handers would be less lateralized in their hand preference for masturbation compared to right-handers (H3). A fourth hypothesis was generated by the right hemisphere hypothesis of emotion. Because emotional context can influence the strength of motor asymmetries, we hypothesized that emotional and sexual context may cause a shift towards the increased use of the left hand in both right-handers and left-handers, as compared to their modified Edinburgh Handedness Inventory score (H4). We also tested the hypothesis that, because of differences between the sexes in motor action and genitalia and the possible greater reliance on fine motor control, women would show greater use of their dominant hand for masturbation than men (H5). To provide contextual data, we also aimed to determine the extent to which hand preference for masturbation related to other every day functional asymmetries, such as footedness, and eye dominance. Furthermore, we examined preferences for cheek kissing laterality

because these provided contextual data regarding emotion-related behavioural preferences. In particular, it provided data on the lateralization of a behaviour typically involving social emotions (kissing), in comparison to the lateralization of masturbation, a behaviour typically involving private emotions and sexual arousal.

Method

Participants and ethical considerations

We surveyed 406 participants who were UK residents, aged 18 or above, recruited via Prolific.co. Participants were anonymously paid a small financial reward in line with Prolific tariffs. We sampled based on sex (male, female) and handedness (left, right) using Prolific's pre-screening facilities, with the aim of having approximately equal numbers per cell. There were 104 female left-handers, 103 female right-handers, 100 male left-handers, and 99 male right-handers. Age was not reported by 3 participants. The mean sample age for the remaining 403 participants was 34 years, median = 31, SD = 12.4, minimum = 18, maximum = 86. Mean age did not differ significantly as function of handedness $M_{\text{left-handers}} = 34.9$, $M_{\text{right-handers}} = 33$, $t(401) = 1.59$, $p = .114$, but it did as a function of sex $M_{\text{female}} = 32$, $M_{\text{male}} = 36$, $t(401) = 3.26$, $p < .001$.

We advised prospective participants at recruitment that the study involved responding to questions concerning hand use for masturbation and their frequency of masturbation, and asked them not to take part if the topic of masturbation might trigger religious, moral, personal, or psychological discomfort. We also explained that we would ask about hand use for some other everyday tasks, such as writing and using everyday objects, and asked prospective participants not to take part if their culture or beliefs determined strongly which hand they used for specific actions. The study was reviewed and approved by the School of Psychology Ethics Committee at the University of Chester, and complied with British Psychological Society Research Ethics Guidelines.

Materials and procedure

Participants were surveyed in mid-March 2021 using Qualtrics. Informed consent was obtained electronically via participants' agreement with statements with regard to reading and understanding the study information, data use, the voluntary nature of participation, freedom to withdraw, freedom to withhold responses, and agreement with the statement "I give my consent". Participants answered a modified version of the short (10-item) Edinburgh Handedness Inventory (Oldfield, 1971), with questions

about which hand was used for specific activities, explaining that some of the activities required both hands and that, in these cases, the part of the task or object for which hand use was enquired about was indicated in parentheses: writing, drawing, throwing, scissors, toothbrush, knife (without a fork), spoon, broom (upper hand), striking a match (match), opening a box (lid). Response options here and throughout (substituting feet, eyes, and cheeks where appropriate) were: "Always left, Usually left, Both hands equally, Usually right, Always right". Following this, there were three questions from McManus (1979) about which foot people used to: kick a ball (accurately, e.g., at a goal), kick a ball if accuracy was not important, and stand on one leg. Next, in three eyedness questions (McManus, 1979), participants were asked which eye they would use to: look down a microscope, look through a telescope, and look through a keyhole. Then, an image (Figure 1) of a symmetrical outline face with eyes, nose, mouth, and ears (no hair) was shown, with the cheek that was leftmost from the viewer's perspective labelled "left cheek" and the other "right cheek", with the question "Imagine that the picture above is of someone you are emotionally close to. If you approach them, to kiss them on the cheek, which cheek would you kiss them on? (Left cheek / right cheek as shown on the picture)", with the five response options as before. The next question, from Leitenberg, Detzer, and Srebnik (1993) asked "If you masturbate, on average how frequently have you done this in the past month?", with response options "Not at all in the past month [subsequently scored as 0, though participants responded to verbal labels only], Once in the past month [1], Two or three times in the past month [2], Around once a week [3]", and continuing the same phrasing, Around twice [4], three times [5], four [6], five [7], six [8], seven times [9], or Around eight times or more a week [10]. Finally, we asked participants about their hand use for masturbation via three questions: "If you masturbate please indicate which hand you typically use"; "If your hands are not holding anything else, please indicate which hand you typically use to masturbate", and "If you hold a sex

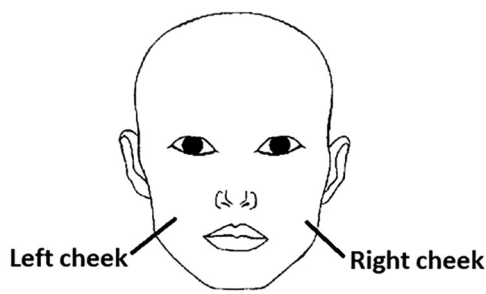

Figure 1. Image used in kissing question.

Note: The figure indicates the labels shown to participants to ask them which cheek of an emotionally close person they would kiss, with left-right labels reflecting the viewer's perspective.

aid to masturbate, such as a vibrator, please indicate which hand you typically use" with the same response options as for the EHI, supplemented with "Not applicable". The survey ended with a debrief which included a link to a UK National Health Services sexual health site (NHS, 2021) which explained that masturbation was normal, common, and harmless. There was also a link to a Mind (2021) information and support site in case of concerns related to mental health.

Analysis strategy and design

Our dependent variables were numerically scored as described in the results. We treated data as parametric measures where all relevant measures consisted of scale data that were summarized over a number of items (e.g., the modified EHI), and non-parametric measures where ordinal data originated from single items (e.g., the masturbation laterality questions). In one instance (use vs. non-use of sex aids) we analysed nominal data.

Our analyses were in part used for calibration, to examine if known previous effects would replicate in our data. This would anchor our data where possible and yield confidence in the new aspects of our data. Our analyses also tested the specific hypotheses derived from theoretical positions, as set out in the Introduction. We supplied some additional analyses which may be of descriptive interest to readers, given the novelty of the research.

Our major factors of interest were handedness and sex, both between-subjects variables, analysed using independent-samples analyses. We also compared different measures, adopting a within-subjects design, using related-samples analyses. Our analyses were frequentist, and included effect sizes.

Data processing and missing data

Scoring was done so that all measures could be compared on the same basis. The masturbation questions were single items, and it was therefore not possible to calculate meaningful laterality quotients (LQ) from these using the traditional EHI scoring method (Oldfield, 1971). When there is only one item, "usually" and "always" responses neutralize to the same score when calculated using the LQ method. For this reason, we used a modified scoring method, which was applied to all scales to facilitate making direct statistical comparisons, as dictated by our hypotheses.

The first part of scoring involved changing the Likert scale verbal labels with −100–100 ("always left" −100, "usually left" −50, "neutral" 0, "usually right" 50, "always right" 100), and changing "not applicable" in the masturbation data to "missing" [999]. These numerical scores were chosen for ease of interpretation. Verbal labels for masturbation frequency data were coded numerically 0–10 as described in the Method; the higher the more frequent. Mean scores were

calculated for the modified EHI, footedness, eyedness, and masturbation hand. If data were missing from a scale with multiple items, scale means were calculated over the remaining items. For the modified EHI, 13 cells were missing (0.3%). For both footedness and eyedness it was one cell each (0.8%). For single item questions, missing data were simply omitted from the relevant analyses: There were no missing data for kissing of the cheek, or for masturbation frequency, 18 (4.4%) for masturbate (typical hand), 20 (4.9%) for masturbate (hand not holding anything else), and 185 (45.6%) for masturbate (sex aid). More details on the pattern of missing data in the masturbation with a sex aid question are reported shortly because this is of separate interest. In the interest of Open Science, the data thus processed are available via the Supplemental Online Material.

Results

Means and standard deviations for all lateral preference measures are in Table 1. In addition, distributions of responses are shown in Figures 2–4 (modified EHI, footedness, eyedness, respectively, treated as scale data, Figures produced using Flexplot General Linear Model; Fife, 2021; Jamovi Project, 2021), and Figures 5 and 6 (Masturbation hand questions and Cheek kissing, respectively, ordinal data on a five-point scale), and Figure 7 (Masturbation Frequency, ordinal data on a 10-point scale).

Calibration analyses: handedness checks, sex aids, and masturbation frequency

Our first set of analyses had the aim of checking whether previously reported patterns replicated in our sample. These concerned the modified Edinburgh Handedness Inventory, footedness and eyedness items, with higher predicted scores for right-handers, indicating more use of the dominant hand. We did not use a cut-off value on the modified EHI to determine handedness. Instead we retained the categorization into left- and right-handers from the participants' own self-reported handedness, and used the modified EHI to check for a significant difference between self-reported left- and right-handers. For masturbation frequency we expected higher frequency for men than for women, and we expected more women than men to use sex aids.

First, to check that participant handedness impacted on the baseline lateralization measures (modified EHI, footedness, and eyedness) a series two-way ANOVAs was run. As anticipated, modified Edinburgh Handedness Inventory scores showed a significant main effect of handedness $M_{left\text{-}handers} = -59.33$, $SD = 34.07$, $M_{right\text{-}handers} = 82.86$, $SD = 17.00$, $F\ (1, 402) = 2815.88$, $p < .001$, $\eta_p^2 = .875$. The main effect of sex was not

Table 1. Means and SDs per measure per condition.

Group	Female Left-handed		Female Right-handed		Male Left-handed		Male Right-handed		Total	
Statistic	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
EHI	−59.86	36.50	82.02	18.13	−57.43	34.04	83.80	15.86	11.42	76.10
Foot	−16.51	49.00	50.33	29.01	−16.17	56.73	47.64	32.39	16.01	54.20
Eye	−26.83	64.90	35.62	52.97	−30.33	67.14	38.55	54.80	3.94	68.49
Kiss	−22.86	55.48	7.35	56.90	−21.50	55.17	11.11	53.72	−6.65	57.35
Masturbate typical hand	−46.46	65.17	65.43	47.53	−35.05	72.23	66.84	59.61	12.11	81.78
Masturbate not holding anything else	−46.39	66.63	70.21	45.39	−38.66	71.63	68.88	56.77	13.21	82.77
Masturbate sex aid	−41.56	66.10	67.72	41.63	−28.13	62.14	31.82	71.61	10.41	76.31
Masturbate Frequency	2.37	2.05	2.35	1.96	4.96	2.93	4.79	2.75	3.59	2.75

Note: EHI = modified Edinburgh Handedness Inventory score. All scales except Masturbation Frequency are expressed on a −100–100 scale, −100 = always left, −50 = usually left, 0 = both equally, 50 = usually right, 100 = always right. Masturbation Frequency over the last month was measured on ordinal scale: 0 = Not at all in the past month, 1 = Once in the past month, 2 = Two or three times in the past month, 3 = Around once a week, 4 = Around twice a week, 5 = around three times a week, 6 = around four times a week, 7 = around five times a week, 8 = around six times a week, 9 = around seven times a week, 10 = around eight times or more a week.

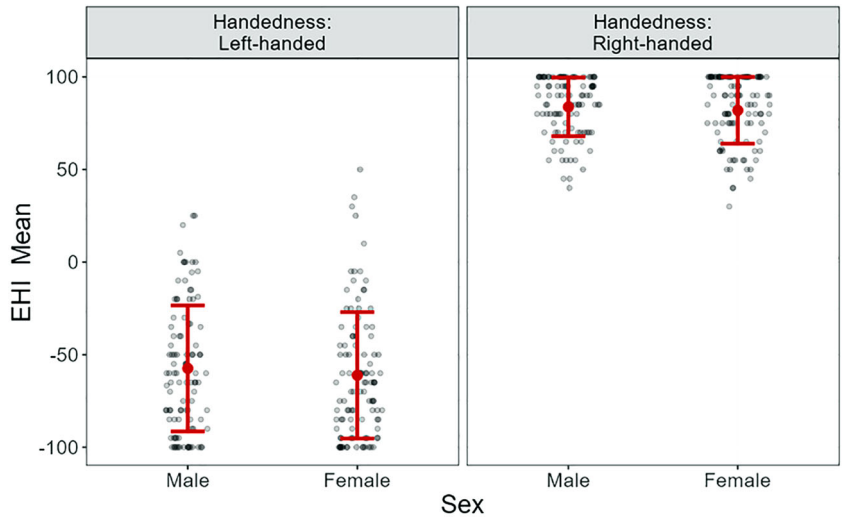

Figure 2. Jittered density plot for Edinburgh Handedness Inventory scores.

Note: To facilitate comparisons across measures, the modified Edinburgh Handedness Inventory (EHI) score was calculated using means across the ten items, expressed here on a scale of −100 (always left) through 0 (both hands equally) to 100 (always right). Data show raw scores as a function of handedness and sex. Bars indicate standard deviations with means represented by dots in their centre.

significant $M_{female} = 10.05$, $SD = 76.74$, $M_{male} = 12.83$, $SD = 76.50$, $F(1, 402) = 1.08$, $p = .30$, $\eta_p^2 = .003$, nor was the interaction between handedness and sex, see means and SDs in Table 1, $F(1, 402) = 0.12$, $p = .73$, $\eta_p^2 = 0.0003$.

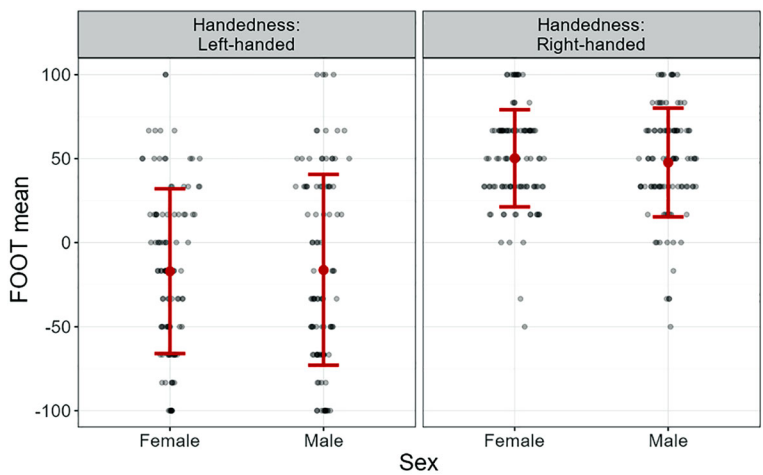

Figure 3. Jittered density plot for footedness.

Note: To facilitate comparisons across measures, footedness was calculated using means across the three items, expressed here on a scale of −100 (always left) through 0 (both feet equally) to 100 (always right). Data show raw scores as a function of handedness and sex. Bars indicate standard deviations with means represented by dots in their centre.

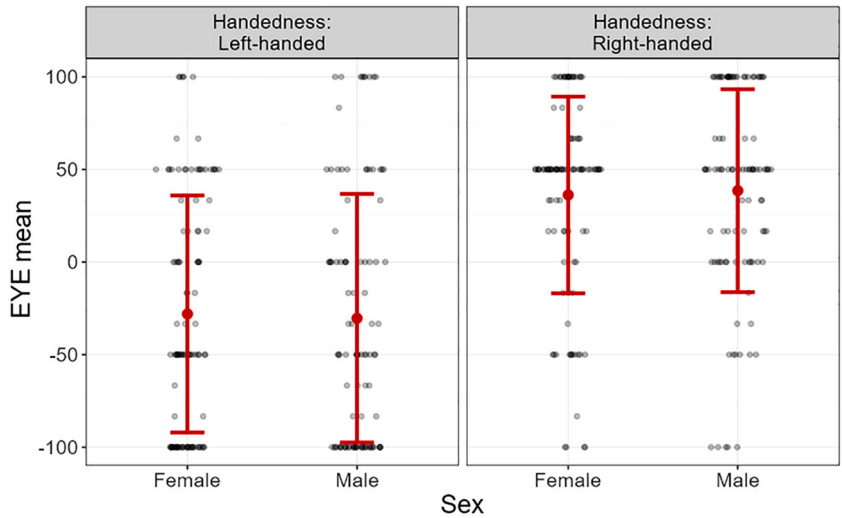

Figure 4. Jittered density plot for eyedness.

Note: To facilitate comparisons across measures, eyedness was calculated using means across the three items, expressed here on a scale of −100 (always left) through 0 (both hands equally) to 100 (always right). Data show raw scores as a function of handedness and sex. Bars indicate standard deviations with means represented by dots in their centre.

A similar pattern was obtained for footedness, with a significant main effect of handedness, $M_{left\text{-}handers} = -16.59$, $SD = 52.80$, $M_{right\text{-}handers} = 48.93$, $SD = 30.61$, $F(1, 402) = 231.97$, $p < .001$, $\eta_p^2 = .366$, a non-significant main effect of sex, $M_{female} = 16.43$, $SD = 52.41$, $M_{male} = 15.58$, $SD = 56.14$, $F(1, 402) = 0.04$, $p = .84$, $\eta_p^2 = 0.00009$, and a non-significant interaction between handedness and sex, see means and SDs in Table 1, $F(1, 402) = 0.15$, $p = .70$, $\eta_p^2 = 0.0004$.

Eyedness showed the same pattern again, with the main effect of handedness reaching significance, $M_{left\text{-}handers} = -29.17$, $SD = 65.41$ $M_{right\text{-}handers} = 37.38$, $SD = 53.81$, $F(1, 402) = 124.73$, $p < .001$, $\eta_p^2 = .237$, but not the main effect of sex, $M_{female} = 3.95$, $SD = 66.94$, $M_{male} = 3.94$, $SD = 70.23$, $F(1, 402) = 2.221e\text{-}6$, $p = .99$, $\eta_p^2 = 5.526e\text{-}9$, nor the interaction, see Table 1 for means and SDs, $F(1, 402) = 0.15$, $p = .70$, $\eta_p^2 = 0.0004$.

Analyses for all three measures showed that the patterns in the sample replicated previous patterns with these standard questionnaires (Porac, 1997), and our self-declared left-handers and right-handers calibrated well against these measures. This provided confidence that their self-declared handedness status was reliable.

Secondly, we examined the hand choices vs. "not applicable" choices in the use of sex aids such as vibrators. Use of sex aids was more common in women (75% users, 25% non-users, or 156 vs. 51/207) than in men (33% users vs. 67% non-users, or 65 vs. 134/199). We used Chi Square tests to analyse whether these differences were significant. The proportions

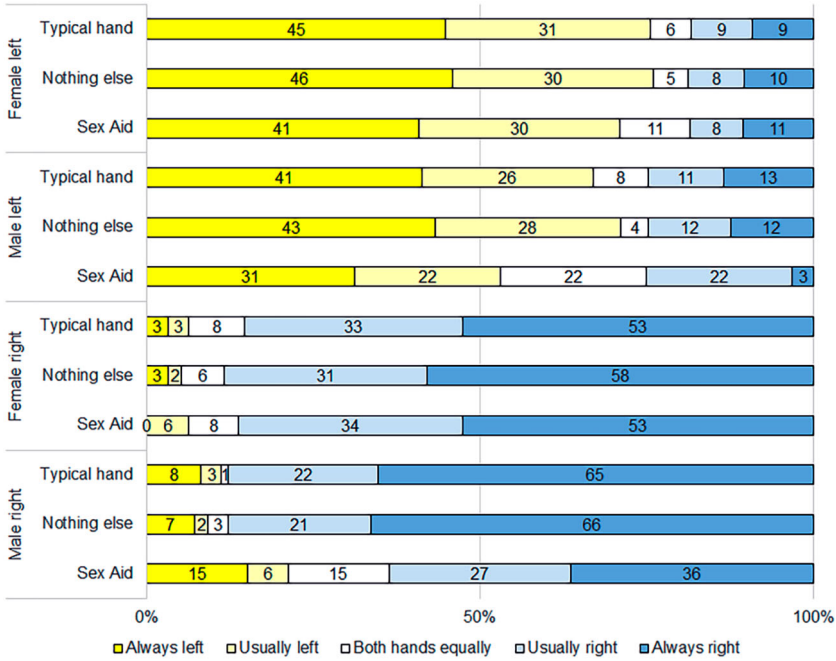

Figure 5. Hand use for masturbation.

Note: Percentage observations as a function of sex and handedness of responses to the three masturbation laterality questions "If you masturbate please indicate which hand you typically use"; "If your hands are not holding anything else, please indicate which hand you typically use to masturbate", and "If you hold a sex aid to masturbate, such as a vibrator, please indicate which hand you typically use". Totals do not always add to 100% due to rounding.

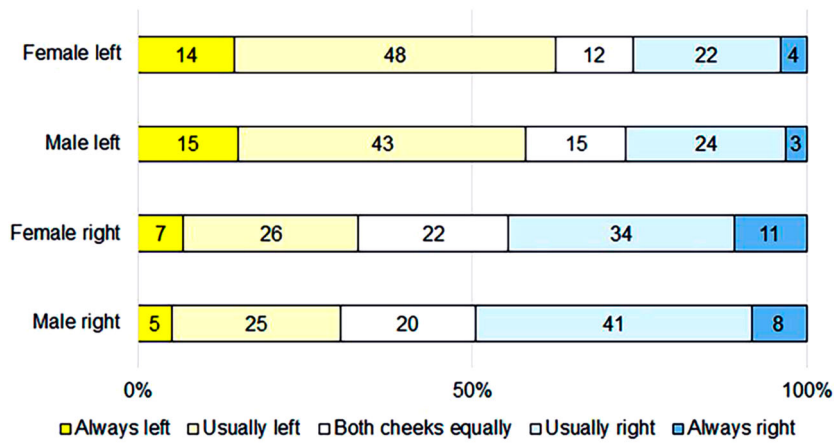

Figure 6. Cheek kissing preference.

Note: Percentage observations of responses to the kissing cheek laterality question, with the left cheek and right cheek being expressed from the perspective of the viewer, as shown in Figure 1. Totals do not always add to 100% due to rounding.

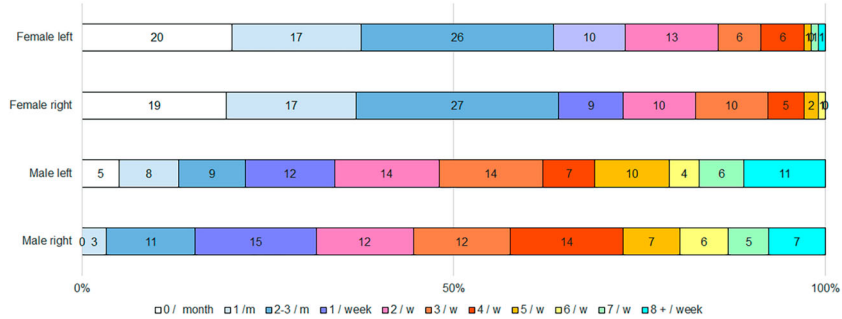

Figure 7. Frequency of masturbation.

Note: Percentage observations of responses to the masturbation frequency question. Abbreviations: / m = per month; / w = per week, 8+ = more than 8 times. Totals do not always add to100% due to rounding.

differed significantly from chance expectations, X^2 (1, N = 406) = 74.58, p < .001, d = 0.949, replicating previous research (Herbenick, et al., 2017). We also note that, although there was a small numerical difference in the percentage of sex aid users as a function of handedness (52.9% of left-handers, 55.9% of right-handers), this difference was not significant, X^2 (1, N = 406) = 0.37, p = .54, d = 0.06. This was not part of our focal test questions, but is reported here as an incidental observation that may be of interest to readers.

Thirdly, masturbation frequency was higher for men, with a mean of close to 5 indicating an average of around three times per week, with the women's mean of close to 2 indicating around 2 or 3 times in the last month, which was a significant difference based on Mann–Whitney tests, U = 9860, N_{female} = 207, N_{male} = 199, Z = 9.15, p < .001, d = 1.026. The more frequent masturbation in men replicates prior research (Leitenberg, Detzer, & Srebnik, 1993). Once again, not of focal interest to our test questions, but an additional observation was that there were no differences as a function of handedness, with means of 3.64 vs 3.55 for left vs. right-handers, respectively, falling between once and twice per week, U = 20522.5, $N_{left\text{-}handed}$ = 204, $N_{right\text{-}handed}$ = 202, Z = 0.69, p = .945, d = 0.032.

In all, the calibration analyses replicated patterns observed in prior research, thus providing a basis for confidence in the new elements of the data. Incidental novel findings showed no effects of handedness on the use of sex aids or masturbation frequency.

Handedness and sex effects on cheek kissing laterality

Cheek kissing acted as a measure of a motor behaviour that may be affected by emotions, hence its laterality provided important contextual information. For kissing the cheek of someone to whom they were emotionally close, participants showed modest lateralized preferences as a function of handedness,

($M_{left\text{-}handers} = -22.5$, $SD = 55.10$, $M_{right\text{-}handers} = 9.41$, $SD = 55.19$), with a tendency for left-handers to kiss the cheek that was leftmost from their own perspective (i.e., the receiver's right cheek as shown in Figure 1) and a slightly weaker tendency for right-handers to kiss the rightmost cheek from their perspective. This effect of handedness was significant, $U = 14185$, $N_{left\text{-}handers} = 204$, $N_{right\text{-}handers} = 202$, $Z = 5.66$, $p < .001$, $d = 0.58$. The effect of sex on the laterality of cheek kissing was not significant, $M_{female} = -7.97$, $SD = 58.06$, $M_{male} = -5.28$, $SD = 57.35$, $U = 19992$, $N_{female} = 207$, $N_{male} = 99$, $Z = .53$, $p = .59$, $d = 0.047$.

Further analyses showed that there was a significant overall preference to kiss the left cheek from the viewer's perspective, tested via a one-sample Wilcoxon test against the neutral value of 0, $M_{total} = -6.65$, $SD = 57.35$, $W = 24408$, $p = .019$, $d = 0.12$. Broken down by handedness, the absolute preference kissing leftwards shown by left-handers ($M = -22.55$) was significant, $W = 4289$, $p < .001$, $d = 0.41$, as was the preference for kissing rightwards by right-handers ($M = 9.41$), but with a smaller effect size for the latter, $W = 7638$, $p = .018$, $d = 0.17$. The analyses showed that the overall significant preference to kiss the left cheek (from the perspective of the kisser) was carried by the left-handers' stronger left-cheek preference dominating the weaker right-cheek preference shown by the right-handers. In all, there was subtle evidence of leftward lateralization of this emotion-related behavioural preference.

Effect of handedness on masturbation laterality

To examine the data for a main effect of handedness on masturbation laterality before focal hypothesis testing, we first analysed hand use for masturbation as a function of handedness, using Mann–Whitney tests. For each of the three, (typical hand, hand holding nothing else, sex aid), there were significant differences.

For hand typically used for masturbation ($M_{left\text{-}handed} = -40.80$, $SD = 68.99$; $M_{right\text{-}handed} = 65.54$, $SD = 54.54$), there was a significant effect of handedness, $U = 5575$, $N_{left\text{-}handed} = 195$, $N_{right\text{-}handed} = 193$, $Z = 12.42$, $p < .001$, $d = 1.71$.

A similar pattern was found for masturbation while holding nothing else, ($M_{left\text{-}handed} = -42.49$, $SD = 69.28$; $M_{right\text{-}handed} = 68.91$, $SD = 51.97$), again showing a significant effect of handedness, $U = 5154.5$, $N_{left\text{-}handed} = 193$, $N_{right\text{-}handed} = 193$, $Z = 12.78$, $p < .001$, $d = 1.82$.

As noted before, many participants, particularly men, indicated that the third question about their masturbation hand choice using a sex aid, e.g., a vibrator, was not applicable to them, but the data for those who did indicate a choice, the pattern followed similar hand use as for the other two questions, ($M_{left\text{-}handed} = -37.50$, $SD = 65.26$; $M_{right\text{-}handed} = 56.20$, $SD = 55.15$), with a significant effect of handedness, $U = 1927$, $N_{left\text{-}handed} = 108$, $N_{right\text{-}handed} = 113$, $Z = 9.01$, $p < .001$, $d = 0.31$. The latter analysis showed that, even with a

strongly reduced number of valid responses, the hand choices as a function of handedness remained stable, and the effect of handedness on hand used for masturbation remained robust. The means clearly indicated an overall tendency to use the dominant hand, with this tendency being numerically stronger in right-handers. We report further analyses of this asymmetry shortly.

Not related to specific hypotheses, but of separate interest was the impact of the specific masturbation question (typical hand vs. not holding anything else) on the laterality responses. Overall, the means did not differ significantly on a Wilcoxon test, $M_{typical} = 12.11$, $SD = 81.78$; $M_{nothing\text{-}else} = 13.21$, $SD = 82.77$, $W = 295.5$, $N_{negative} = 18$, $N_{positive} = 16$, $N_{tied} = 351$, $Z = 0.037$, $p = 0.97$, $d = 0.007$, suggesting no major difference.

Testing hypotheses 1: strong and significant dominant hand preference

Hypothesis 1 was that there would be a strong dominant hand preference for masturbation overall. To test this hypothesis, we calculated a measure of the strength of the dominant hand preference, expressing how far in the predicted direction this was from 0, with positive values indicating that the observed value was in the predicted direction. We used a non-parametric one-sample Wilcoxon test to test for differences from 0. Overall, there was a strong and significant preference to use the dominant hand, with means of 53.09 ($SD = 63.031$) for hand typically used, $W = 56790$, $p < .001$, $d = .84$. This was echoed in hand used when not holding something else, $M = 55.70$, $SD = 62.57$, $W = 58340$, $p < .001$, $d = .89$, and for hand used with a sex aid, $M = 47.06$, $SD = 60.89$, $W = 16266$, $p < .001$, $d = .77$. All these results support Hypothesis 1.

Testing hypothesis 2: masturbation laterality stronger than modified EHI

Hypothesis 2 was formulated based on the notion that masturbation laterality may be a purer measure of handedness than other measures, because, as a private behaviour, it may not be socially or societally conditioned and thereby diluted. For this hypothesis to be supported, the strength of preference measure described in the previous subsection would have been expected to be greater for masturbation measures than for the modified EHI. However, as was evident from the means in Table 1, masturbation laterality was not stronger than EHI-based laterality. In fact, the opposite was the case. For masturbation with the typical hand, $M_{masturbation} = 53.09$, $SD = 63.21$, the means was significantly lower than the EHI ($M_{EHI} = 71.04$, $SD = 29.25$) on a two-sample Wilcoxon test, $W = 33989$, $N_{negative} = 164$, $N_{positive} = 164$, $N_{tied} = 60$, $Z = 4.08$, $p = < .001$, $d = .29$. Masturbation with the hand not holding

anything else showed a similar difference, $M_{masturbation} = 55.70$, $SD = 62.57$, $M_{EHI} = 71.03$, $SD = 29.06$, $W = 30994$, $N_{negative} = 152$, $N_{positive} = 169$, $N_{tied} = 65$, $Z = 3.10$, $p < .001$, $d = .26$, as did masturbation with a sex aid, $M_{masturbation} = 47.06$, $SD = 60.89$, $M_{EHI} = 70.92$, $W = 12551$, $N_{negative} = 113$, $N_{positive} = 72$, $N_{tied} = 36$, $Z = 5.42$, $p < .001$ $d = .42$. Note that the means for the modified EHI were slightly different across the three comparisons due to different missing data on the masturbation measure, leading to elimination of pairs of data, impacting the EHI. Thus, Hypothesis 2 was not supported, and in fact significant evidence to the contrary emerged.

Testing hypothesis 3: left-handers less lateralized than right-handers

We tested whether left-handers were less lateralized than right-handers using our strength of preference measure, which disregarded the direction of the difference from neutral, and only captured the distance from the neutral zero point. The results are presented in Table 2. For all measures except eyedness and cheek kissing, right-handers showed a significantly stronger preference for their dominant side than left-handers. For eyedness, there was no significant difference. The preference for the dominant side in cheek kissing was significantly stronger in left-handers, as noted earlier. This will be interpreted in the discussion.

Testing hypothesis 4: emotional dimension causing leftward shift

Hypothesis 4 was derived from the right hemisphere hypothesis of emotion and led to an expectation of greater use of the left hand for masturbation compared to the modified EHI. To test this, we compared the EHI means to the masturbation scores in their originally scored form (not strength of

Table 2. Strength of hand preference.

	Left-handed		Right-handed		Mann-Whitney test				Effect size
	Mean	SD	Mean	SD	U	N_L, N_R	Z	*p*	d
EHI	59.33	34.06	82.86	17.00	11988.0	204, 202	7.34	< .001	0.87
Foot	16.58	52.80	48.93	30.61	13277.5	204, 202	6.25	< .001	0.75
Eye	29.17	65.41	37.38	53.81	19665.5	204, 202	0.81	0.418	0.14
Kiss Cheek	22.55	55.10	9.41	55.19	17811.5	204, 202	2.48	0.013	0.24
Masturbate typical hand	40.77	68.99	65.54	54.41	15013.5	195, 193	3.75	< .001	0.40
Masturbate holding nothing else	42.49	69.28	68.91	51.97	14642.5	193, 193	4.00	< .001	0.43
Masturbate sex aid	37.50	65.25	56.19	55.15	5151.5	108, 113	2.12	0.034	0.31

Note: Means, standard deviations, and outcomes of Mann-Whitney tests. Abbreviations: EHI = Modified Edinburgh Handedness Inventory score, $N_L = N_{left\text{-}handers}$, $N_R = N_{right\text{-}handers}$,; Mean values refer to mean absolute distances away from the neutral "both equally" point, set to zero for this analysis.

preference as in the previous two subsections, because strength of preference neutralized for side). Means differed subtly in either direction depending on the measure of masturbation used, but not significantly so in any of the comparisons. Masturbation with the typical hand showed an overall mean of 12.11, SD = 81.78, slightly more rightwards than the mean for the EHI, $M_{EHI} = 11.39$, SD = 76.06, but not significantly so, W = 27349, $N_{negative} = 159$, $N_{positive} = 169$, $N_{tied} = 60$, Z = .22, $p = .83$, d = .01. Masturbation not holding anything else showed a similar pattern in the same direction, $M_{masturbation} = 13.21$, SD = 82.77, $M_{EHI} = 11.61$, SD = 75.95, W = 26136, $N_{negative} = 156$, $N_{positive} = 165$, $N_{tied} = 65$, Z = .18, $p = .86$, d = .03. For masturbation with a sex aid the means went in the opposite direction, but not significantly so, $M_{masturbation} = 10.41$, SD = 76.31, $M_{EHI} = 14.56$, SD = 75.73, $p = .32$, d = .07, W = 9938, $N_{negative} = 95$, $N_{positive} = 90$, $N_{tied} = 36$, Z = 1.01, $p = .31$. In all, there was no support for Hypothesis 4, in which the hypothesized role of the right hemisphere in emotion led to a predicted leftward shift for masturbation compared to the EHI.

Testing hypothesis 5: effect of sex on masturbation laterality

Women potentially require a higher level of fine motor control for masturbation than men, resulting in greater use of their dominant hand. This hypothesis was tested by examining whether there was a stronger preference for the dominant hand in women, particularly for manual masturbation as opposed to masturbation with a sex aid. Using the strength of preference measures, means showed no significant differences for the two manual masturbation questions, ($M_{female} = 55.18$, SD = 58.40; $M_{male} = 51.03$, SD = 53.09), U = 18574.5, $N_{female} = 193$, $N_{male} = 195$, Z = .24, $p = .81$, d = 0.07, as was also the case for hand use for masturbation while not holding anything else ($M_{female} = 57.59$, SD = 58.78; $M_{male} = 53.83$, SD = 66.18), U = 18505.5, $N_{female} = 191$, $N_{male} = 195$, Z = .12, $p = .91$, d = 0.06. However, the opposite pattern was significant for masturbation with a sex aid, where women did show stronger hand preferences than men, ($M_{female} = 54.17$, SD = 57.07; $M_{male} = 30.00$, SD = 66.62), U = 4014.5, $N_{female} = 156$, $N_{male} = 65$, Z = 2.58, $p = .01$, d = .40. This pattern clearly is the opposite of what Hypothesis 5 predicted, with the predicted sex differences for manual masturbation not being significant, but with a stronger dominant hand preference by women for masturbation with a sex aid. This will be further interpreted in the Discussion.

Correlation of masturbation hand preference with other measures

Finally, we were interested in establishing correlations between our key measures in their raw score form. Because hand use for masturbation using

a sex aid question had many missing data, we did not include this measure. In addition, hand use for masturbation with the typical hand, and the hand holding nothing else correlated very strongly with each other on a Spearman's rho correlation, $r_s = .97$, $p < .001$, N = 385. We therefore used hand typically used for masturbation as the representative measure of masturbation laterality to examine how this correlated with other behaviours. The results are in Table 3, and these showed that masturbation laterality correlated most strongly with the scores from the modified EHI, followed by footedness and eyedness. The correlation with the kissed cheek was significant, but weak.

Discussion

The findings clearly addressed the hypotheses outlined in the Introduction. The hypothesis (H1) that people would strongly prefer to use their dominant hand to masturbate was confirmed in the data, with 79% of people always/usually preferring their dominant hand. There was no evidence for the lay belief that men often masturbate with their non-dominant hand because it will feel "like someone else". The hypothesis (H3) that left-handers would be less lateralized for hand use for masturbation was also confirmed, with 86.5% of right-handers preferring their dominant hand compared to 71.5% of left-handers. This result corresponded to the findings of other studies that had found weaker lateralization of unimanual motor behaviours in left-handers (McManus et al., 2016).

The hypothesis (H2) that handedness for masturbation might be a purer measure of handedness than the EHI, due to it being less influenced by social factors, was rejected, with the EHI proving to be a stronger measure of handedness. This shows that despite the private nature of masturbation (Kirschbaum & Peterson, 2018), there was no greater tendency to use the dominant hand for masturbation compared to other motor behaviours. In addition, the hypothesis (H4) that greater specialization of the RH for sexual arousal and emotion would cause a shift towards greater use of the left hand, in both right-handers and left-handers, did not receive support. Unlike other behaviours, such as kissing and cradling, where the emotional context influences lateralized motor behaviour (Ocklenburg et al., 2018), this appeared not to be the

Table 3. Correlation Matrix for masturbation and other behaviours.

	EHI	Foot	Eye	Kiss Cheek
Foot	0.680	–		
Eye	0.475	0.439	–	
Kiss Cheek	0.259	0.202	0.216	–
Masturbate	0.630	0.512	0.344	0.183

Note: EHI = modified Edinburgh Handedness Inventory score. The correlation coefficients are Spearman's rho. For all, $p < .001$.

case for masturbation. This might be because cradling, kissing, and embracing are social behaviours, whereas masturbation is primarily a private behaviour.

Finally, the hypothesis (H5) that females would show greater use of their dominant hand for masturbation than men, particularly for manual masturbation, due to a greater need for fine motor control, was not supported. Males and females preferred using their dominant hand to a similar extent (77% males, 81% females). Interestingly, however, for the use of sex aids women were found to use their dominant hand more than males. A possible reason for this difference is that when using a sex aid, males may be more likely to manipulate their genitalia with their dominant hand, and hold the sex aid in their non-dominant hand to stimulate other regions.

In addition to showing a weaker hand preference for masturbation, left-handers were also less strongly lateralized than right-handers for footedness. This replicates observational findings (Nachshon & Denno, 1986) and strengthens the view that the data accurately reflect the participants' behaviour. For eyedness the degree of lateralization did not differ significantly between left-handers and right-handers. This might be because eyedness is not as closely related to hand preference as is footedness (Nachshon & Denno, 1986), making the relationship between eyedness and handedness less consistent in both left- and right-handers.

For cheek kissing an interesting lateralization pattern emerged. Research studies have found that head tilting during kissing is influenced by handedness (Ocklenburg & Güntürkün 2009), and embracing is influenced by emotional context, with a leftward shift in emotional embraces (Packheiser et al., 2019). Both of these influences were observed in our data on cheek kissing. There was an overall bias for participants to kiss the left cheek (from the perspective of the kisser) of a person they were emotionally close to who was facing them. This effect was qualified by a significant effect of handedness, with left-handers showing a significant tendency to kiss the left cheek and the right-handers the right cheek, with the stronger tendency in the left-handers carrying the overall left-cheek bias. In addition, compared to the stronger rightward lateralization of handedness, footedness and masturbation, for cheek kissing there was an overall stronger leftward lateralization. This leftward bias in cheek kissing is consistent with the right hemisphere hypothesis of emotional asymmetries, with the greater involvement of the RH biasing motor behaviour towards the left (Ocklenburg et al., 2018). A further possibility is that it is related to a more general leftward bias when interacting with visual stimuli (Ciricugno et al., 2021; Jewell & McCourt, 2000; Nicholls & Roberts, 2002; Rodway & Schepman, 2020). Both interpretations require further research to determine the cause of this effect.

Chapelain et al. (2015) previously used a self-report measure of cheek kissing, similar to the one used in the present study. They measured choice of cheek and number of kisses for social greetings from various regions

throughout France, and found an effect of region on cheek choice but no effect of handedness. The discrepant effects of handedness between Chapelain et al.'s research and the present study can be explained by the fact that cheek kissing for a social greeting, involving multiple kisses, is a very different interaction from a single kiss on the cheek of an emotionally close person. Importantly, the results from the present study replicate previous effects of handedness on lateralized kissing biases (Ocklenburg & Güntürkün 2009; Karim et al., 2017), with our study using a different task and a large sample of left-handers.

Other results were also in line with expectations and showed that the data calibrated well with previous research. Men were found to masturbate more than women, replicating previous findings (Leitenberg, et al., 1993; Driemeyer, et al., 2017) and a similar frequency of sex aid use by males for masturbation (33%) was found to that reported by Herbenick et al. (2017). The use of sex aids by women in our sample (75%) was somewhat higher (52.5%) than reported by Herbenick et al. (2009), and the 50.2% of vibrator or dildo use reported in Herbenick et al. (2017). This could be due to several factors, such as our participants self-selecting to opt into a study about masturbation, an increase in the use of sex aids over recent years, cultural differences between the US and the UK, and the fact that our data were collected during the coronavirus / Covid-19 pandemic.

In a survey of sexual behaviours of people in the United States, a substantial proportion of men (82.3%) and women (60.4%) reported having watched pornography (Herbenick et al., 2017). In the present study, participants were asked which hand they typically used to masturbate and which hand they typically used if they were not holding anything else. This was to check, for those participants who masturbated while viewing pornography (and which could involve the use of their dominant hand to control a computer mouse, or hold written material), if there was an increase in the use of the dominant hand when they were not holding anything else. However, we found no significant difference overall between these questions. Our data therefore suggested that preferred hand use for masturbation was not strongly determined by holding other objects and that participants continued to use their dominant hand for masturbation even when they might be holding something else. A possible limitation, however, is that we did not directly ask which hand they used when viewing pornography, and it is possible that if we had asked this question there might have been evidence of a shift towards using the non-dominant hand.

In the majority of left- and right-handers, eyedness and footedness was congruent with their handedness, replicating previous findings (Bourassa, McManus, & Bryden, 1996; Porac, 1997). In addition, hand preference for masturbation correlated more strongly with scores on the modified Edinburgh Handedness Inventory, than with footedness, eyedness, or kissing.

Masturbation had a strength of hand preference (53 for typical hand) that fell between that shown via the modified EHI score (71), and both footedness (32) and eyedness (33), with significant differences between masturbation with the typical hand and modified EHI. This suggests that, although dominant hand preference for masturbation was weaker than that measured via the modified EHI, it may nevertheless be a reliable measure of hand preference in general. It can also be noted that historically in some cultures, such as India and ancient Rome, masturbation has been specifically linked with using the left hand (Derrett, 2006). Despite this historical association, there was no evidence in our sample of UK participants that such an association caused large numbers of right-handers to use their left hand.

An interesting incidental finding is that there were no differences in masturbation frequency between left- and right-handers for either men or women. Occasionally, research has tended to pathologise left-handedness (see Porac, 2015 for a discussion), rather than treating it as a natural variation that provides fitness benefits (Groothuis, et al., 2021), with an emphasis on health issues (Peters et al., 2006) and increases in atypical sexual behaviours (Fazio, Lykins, & Cantor, 2014). Also, some theories of the origin of left-handedness have linked it to increased levels of prenatal testosterone (see Grimshaw, Bryden, & Finegan, 1995; Richards et al., 2021, for discussions). As higher levels of testosterone in adults have been associated with more frequent masturbation (O'Connor, et al., 2011), theoretically, although via a speculative leap, it could be hypothesized there might be a difference in masturbation frequency between left- and right-handers. There was no evidence of this in the data, which is in line with the body of research showing that left- and right-handers are much more similar to each other than they are different (see Porac, 2015 for a review).

There are a number of potential limitations with the present study. The results might be specific to our UK sample and our exclusion criteria, which asked prospective participants whose culture or beliefs strongly determined which hand they used for certain actions not to take part. This was to elicit reports of natural, rather than culturally-conditioned behaviours. It may be that cultures that associate using the left hand with activities that may be classed as impure could show different patterns of behaviour, perhaps with a higher proportion of right-handers using their left hand for masturbation. The data were also based on self-report, rather than observation, for obvious ethical and moral reasons, raising the possibility they did not accurately represent participants' behaviour. However, the results calibrate well with findings from other research, which gives confidence in their accuracy and validity. In addition, it is likely that the anonymity and privacy of the survey enabled participants to feel more able to respond honestly to the questions, than if the data had been collected in a less anonymous way, even if this had been ethically and morally acceptable. Thus, the constraints

placed on the data acquisition method may not necessarily have been a hindrance in the collection of reliable data.

To summarize, hand preference for masturbation was strongly lateralized, with most people preferring to use their dominant hand, perhaps because it affords greater motor control, or because they use that hand for most activities. Right-handers were more strongly lateralized than left-handers for masturbation, EHI, and footedness, but left-handers more for kissing. There was no evidence for masturbation being more strongly lateralized than the behaviours measured by the Edinburgh Handedness Inventory. A small proportion of people chose to use their non-dominant hand for masturbation. This was not due to other objects occupying their dominant hand. There was no evidence that specialization of the RH for sexual arousal or emotion caused a shift towards greater use of the left hand for masturbation. However, there was a general leftward shift in cheek kissing. This finding is compatible with the RH hypothesis of emotional lateralization, with the greater involvement of the RH during the emotional behaviour of kissing, biasing motor behaviour towards the left. Therefore emotional context may influence lateralized motor behaviour particularly in social settings (such as kissing), rather than in a setting which can induce emotion but which is private (masturbation). In all, masturbation shows a similar pattern of lateralization to other unimanual behaviours in left-handed and right-handed men and women.

Data availability

Supplemental data for this article can be accessed at: https://doi.org/10.6084/m9.figshare.16912966.v1.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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