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Head-turning asymmetries during kissing and their association with lateral preference

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A head-turning bias to the right side is one of the earliest functional asymmetries in human development and is already present during the final weeks of gestation. To test whether head-turning preference is related to other lateral preferences in adults, kissing behaviour of participants towards a symmetrical doll was observed to assess their spontaneous head-turning preference. Additionally, participants' individual handedness, footedness, and eye preference were determined using questionnaires. A significant difference in handedness and footedness, but not eye preference, was found between left- and right-kissers, with right-kissers showing a stronger right-sided bias than left-kissers. These results support the assumption that the head-turning bias in humans may be able to induce or enhance other asymmetries of perception and action.

Keywords: Cerebral asymmetry; Laterality; Handedness; Footedness; Eye preference.

Most human foetuses show a preference to turn their head to the right relative to their body with a clearly lateralised head position evident at gestation week 38 (Ververs, de Vries, van Geijn, & Hopkins, 1994). This right-sided bias in head-turning preference has also been observed in newborns immediately after birth and is one of the earliest functional asymmetries in humans (Hopkins, Lems, Janssen, & Butterworth, 1987). It has been suggested to contribute to the development of the right-sided bias in handedness by generating lateral asymmetries in visual experience and neuromotor activity of the hands (Michel, 1981). This theory is supported by findings that preferential hand use could be predicted by preferential head-turning direction in infants (Konishi, Mikawa, & Suzuki, 1986; Michel, 1981). As no such relation between head-position preference and handedness is observed in ultrasound recordings of human foetuses from 12 to 38

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weeks of gestational age, it probably develops around birth (DeVries et al., 2001).

In contrast to handedness, no relation of footedness and head-turning preference has been found in infants (Dommellöf, Hopkins, & Rönnqvist, 2005). This is in accordance with findings that young children are more often mixed-footed than adults, a significant shift towards a right-sided bias occurring between 8 and 11 years of age (Gabbard & Iteya, 1996; Gentry & Gabbard, 1995). As adults show a consistent right-sided bias in foot preference (Dittmar, 2002), it is of interest to test participants coming from an adult age range to determine the relationship between head-turning preference and footedness and other forms of functional asymmetry like eye preference.

However, the research on head-turning preferences in adults is surprisingly sparse. Nicholls, Clode, Wood, and Wood (1999) asked participants to pose for either an emotive family portrait or an impassive scientist portrait. Their results revealed a clear influence of emotional context on the lateral bias in head turning. Participants were more likely to turn their head to the right to present their left cheek in the emotive condition, whereas the opposite pattern occurred in the non-emotive condition. In another study on portraiture Costa, Menzani, and Bitti (2001) examined 1498 figures from 11 painters and observed no head-turning preference, since leftward and rightward head turning of the portrayed persons were equally distributed. However, it is not clear whether the results of these two studies reflect a true bias in spontaneous head-turning preference at all, as the participants in the study by Nicholls et al. (1999) had to read a script and think about their pose for 30 seconds and the portrayed persons in the paintings analysed by Costa et al. (2001) might have been instructed by the painter to pose in a certain way.

To answer the question whether a spontaneous head-turning bias in adults exists, Güntürkün (2003) observed kissing couples in public places to assess their head-turning preferences. He found a significant bias towards the right side, with 64.5% of the participants kissing to the right and 35.5% to the left. As it is problematic to judge a person's individual head-turning preference from the observation of interacting couples, Barrett, Greenwood, and McCullagh (2006) observed kissing behaviour not only between couples, but also between participants and a symmetrical doll's face to remove the influence of one kissing partner upon the other. Of the participants kissing in couples, 80.8% kissed to the right and 19.2% to the left, whereas 77.5% of the participants kissing the doll kissed to the right and 22.5% to the left. This ratio did not differ significantly from that of the couples, showing that the right-turning bias in kissing behaviour is not influenced by the turning preference of the partner. Moreover, as kissing a partner is a positive emotional situation and kissing a doll is not, these results suggest that the

head-turning bias while kissing is rather due to a motor bias than to an emotive bias as suggested by Nicholls et al. (1999) for head-turning while being portrayed.

To determine how head-turning preferences are related to handedness, Barrett et al. (2006) assessed participant's handedness by asking whether they were right- or left-handed for writing. They did not find a significant difference in handedness between left- and right-kissers. However, as Barret et al. (2006) state themselves, the method to assess handedness used in their study is rather imprecise. A continuous measure of hand preference such as the Edinburgh Handedness Inventory (Oldfield, 1971) is a statistically more powerful instrument for determining handedness. Furthermore it allows an assessment of the relation of head turning and handedness in people with mixed handedness.

The present study had two aims. First, to determine the relation between a continuous measure of handedness and head-turning preference, defined as a lateral flexion of the head at the upper cervical spine; second, to determine whether adult head-turning preference is related to functional asymmetries other than handedness. To this end, participants' footedness and eye preference were also continuously measured and their relation to head-turning preference was assessed. If the head-turning bias were to be related to handedness, footedness, or eye preference of the individual, these four laterality measures could constitute a "package" that derives from a common predisposition. It might even be possible that the head-turning bias defines the ontogenetic primordial from which the other three sidedness entities follow.

METHOD

Participants

A total of 150 healthy undergraduate psychology students (88 females, 62 males) of the Ruhr-University of Bochum participated in the experiment. They were given course credit for their participation and signed an informed consent form. The mean age of the participants was 24.33 years ($SD = 5.09$, range: 18–40 years).

Procedure and materials

Each participant was tested individually in an experimental chamber. First, each participant's head-turning preference was assessed by using a custom-built experimental apparatus consisting of a life-sized symmetrical black plastic head mounted on a height-adjustable tripod. The apparatus was

positioned in front of a black wall in an experimental chamber, which supplied no asymmetrical visual cues. Before testing, the apparatus was adjusted so that the lips of the plastic head were at the same height as the lips of the participant. Participants were asked to kiss the plastic head on its lips and it was recorded whether participants turned their head to the left or to the right when kissing.

Afterwards, all participants filled out the Edinburgh Handedness Inventory (Oldfield, 1971) to determine their handedness, the Waterloo-Footedness Questionnaire Revised (Elias, Bryden, & Bulman-Fleming, 1998) to determine their footedness, and an eye preference questionnaire, which consisted of three questions. To determine the participants' dominant eyes, they were asked which eye they would use to look through a keyhole, down a telescope, and down a monocular microscope (Reiss & Reiss, 1997). Participants had to choose from five different options to answer these questions. These were "Always the right eye", "Usually the right eye", "Both eyes equally often", "Usually the left eye", and "Always the left eye". For each questionnaire, a laterality quotient (LQ) was calculated according to the method of Oldfield (1971). The LQ's range was between -100 and $+100$, with positive values indicating a right-sided preference and negative values a left-sided preference.

RESULTS

The mean LQs were 70.81 ($SD = 49.29$) for handedness, 48.02 ($SD = 46.04$) for footedness, and 39.17 ($SD = 79.34$) for eye preference. Of the 150 participants, 12 (8%) were left-handed, the remaining 138 (92%) were right-handed. A total of 127 (84.7%) of the participants were right-footed, whereas 20 (13.3%) were left-footed (due to technical problems the footedness results for 3 participants were missing). While 38 participants (25.3%) showed a preference for the left eye, 112 (74.7%) had an eye preference favouring the right eye.

Of the 150 participants, 93 (62%) kissed to the right and 57 (38%) kissed to the left. This ratio was significantly different from 50% ($\chi^2 = 8.64$, $p < .01$). No difference in head-turning preference between male and female participants was observed ($\chi^2 = 0.04$, $p = .85$). Right-kissers had a significantly higher mean LQ than left-kissers for handedness, $t(147) = -2.13$; $p < .05$, and footedness, $t(145) = -2.01$; $p < .05$, but not for eye-preference, $t(148) = -0.80$; $p = .43$ (see Figure 1). Of the 93 right-kissers, 89 (95.7%) were right-handed, 82 (88.17%) were right-footed, and 71 (76.34%) had a right eye preference. Of the 57 left-kissers, 49 (85.96%) were right-handed, 45 (78.95%) were right-footed, and 41 (71.93%) had a right eye preference.

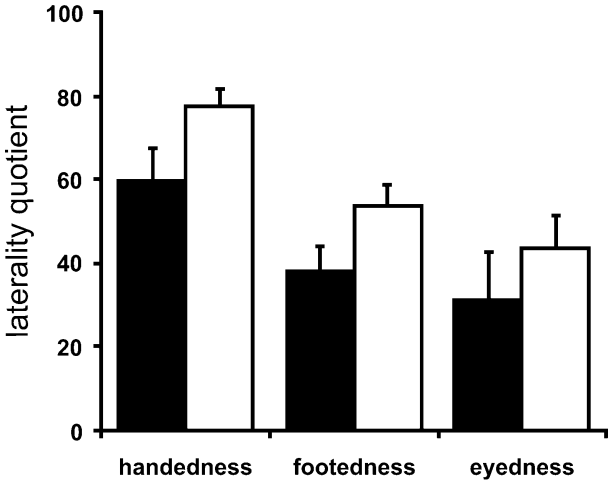

Figure 1. Mean laterality quotient for handedness, footedness, and eyedness for left-kissers (black bars) and right-kissers (white bars). Error bars show standard deviation.

DISCUSSION

The results of the present study replicate the findings of Güntürkün (2003) and Barrett et al. (2006) showing an adult head-turning bias towards the right side, even though we found slightly fewer participants kissing to the right than these authors. Furthermore, as kissing the doll in the present study was not an emotional experience for the participants, our data further support the assumption of Barrett et al. (2006) that the head-turning bias in kissing behaviour is generated by a motor bias and not by emotional processes as suggested by Nicholls et al. (1999).

The first aim of the present study was to determine the relation between head-turning preference and handedness, measured continuously with the Edinburgh Handedness Inventory. In contrast to the findings of Barrett et al. (2006) who did not find a significant difference in handedness between left- and right-kissers, we found that right-kissers showed a significantly higher positive LQ for handedness than left-kissers, indicating stronger right-handedness in right-kissers. This difference might be due to the divergent methods to assess handedness in the two studies: Barrett et al. (2006) only asked their participants whether they were right or left handed for writing. This method is less precise and may produce biased results, whereas the present study used a multi-item questionnaire.

The second goal of the present study was to determine whether adult head-turning preference is related to functional asymmetries other than handedness. To clarify this question we determined the participants' footedness and

eye preference using questionnaires. As for handedness, right-kissers showed a significantly higher positive LQ for footedness than left-kissers, indicating a stronger right-sided footedness in right-kissers. In contrast to this, such a relation was not found for eye preference. This null result might reflect the finding that eye preference has a weaker correlation with handedness than footedness (Dittmar, 2002). However, since the general data structure for eyedness is similar to handedness and footedness, the absence of a significant difference might also be due to methodological problems during the assessment of eyedness: The Edinburgh Handedness Inventory and the Waterloo-Footedness Questionnaire Revised both comprise 10 different items, whereas the eye preference questionnaire used here included only 3 items. Therefore it might not have been able to differentiate correctly between different strengths of lateralisation, as too few lateralisation-specific situations were assessed. Future studies should thus use an eye preference questionnaire containing a larger number of items to clarify this issue.

Taken together the results of the present study clearly show that head-turning preference is related to handedness and footedness. Thus, motor asymmetries of the human body are all right-skewed. This could be due to a central asymmetry of motor organisation from which handedness, footedness, and headedness just follow. However, it is also possible that the embryonic bias for a right-head turn (Hopkins et al., 1990) persists into adulthood and creates a constant bias for an increased visuomotor coupling on the right side that modulates the developing hand and foot motor systems. This could also result in a data pattern like the present one and would explain why head turn preference, handedness, and footedness are interrelated. In animal models (Rogers, 1982; Skiba, Diekamp, & Güntürkün, 2002) it has been demonstrated that an embryonic right head-turning bias creates an imbalance of sensory input that results in the establishment of asymmetries of visual cognitive processes. The present finding of significant interrelations between three sidedness measures could support a similar explanation in humans. However, ontogenetic studies are needed to prove the hypothesis that at least some of the human motor asymmetries are modulated by a lifelong preference for a right head turn.

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