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Attitudes and responses of medical students and professional anatomists to dissecting different regions of the body.

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Short title: Reactions to dissecting anatomical regions

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Abstract

Although there have been many studies assessing emotional responses of medical students to the dissecting room experience, little is known about whether dissecting particular regions of the human body cause more concern than others. Furthermore, no studies have been conducted on the concerns of professional anatomists. In this study, we assessed the hypothesis that medical students are more concerned about the dissection of the face, the perineum and the extremities of the limbs. We also hypothesised that there are gender differences. For the reactions of a group of professional anatomists from the US and Europe we hypothesised that they were less concerned than the medical students and showed no differences across the regions of the body. The hypotheses were tested by means of questionnaires distributed to medical students at Cardiff University and at the Descartes Paris University who had recently completed their anatomy courses. Ethical approval for the study was obtained from the ethical committees at the Cardiff School of Biosciences and at Paris and all data was obtained by consent of the respondents and remained confidential. The findings were complex, although the level of concern was low overall. Some regional differences were discerned, particularly concerning the face, the perineum, the hand and the female chest. Anatomists were less concerned than the students and female students and female anatomists showed more concern than their male counterparts. Few differences were discerned however between student respondents who had positive and neutral attitudes to gender 'politics' and those who espoused negative views. We recommend that, at the start of an anatomy dissection course, time is spent dealing with sensitive issues (including equality and diversity issues), emotional responses, and matters pertaining to mortality. However, we argue that this should not involve hiding regions of the body, nor overreacting to the natural anxiety of students, since doing either of these things could enhance negative reactions and stifle the progress of the student from being a layperson to a competent healthcare professional.

Introduction

Previous studies indicate that medical students believe that the study of gross anatomy is highly relevant to their clinical training; more relevant even than embryology and histology (Moxham and Moxham, 2007; Moxham and Plaisant, 2007; Kerby et al., 2011; Olowo-Ofayoku and Moxham, 2014; Moxham et al., 2016a, 2017). Furthermore, there is evidence that they prefer that they are taught, and learn, gross anatomy by practical means (e.g. by dissection, using cadaveric prosections, and by tuition involving radiological and surface anatomy) (Pabst and Rothkötter, 1997; Hofer, 2006; Patel and Moxham, 2006; Moxham and Moxham, 2007; Moxham and Plaisant, 2007; Körf et al., 2008; Boeckers et al., 2010; Kerby et al., 2011; Olowo-Ofayoku and Moxham, 2014).

There is a considerable literature to suggest that, at least initially, some medical students may be emotionally disturbed by the prospect of being in the dissecting room (Becker et al., 1961; Horne et al., 1990; Evans and Fitzgibbon, 1992; Harvill, 1986; Jordan et al., 1986; Tschernig et al., 2000; Lief and Fox, 1963; McGuire, 1966; Finkelstein and Mathers, 1990; Druce and Johnson, 1994; Shalev and Nathan, 1985; Lee-Tsang-Tan and Kent, 1995; Nnodim, 1996; Abu-Hijleh et al., 1997; Dickinson et al., 1997; Dinsmore et al., 2001; O'Carroll et al., 2002; Snelling et al., 2003; Houwink et al., 2004; Hancock et al., 2004; Arráez-Aybar et al., 2004a&b, 2008; Schwartz et al., 2008; Bonnaud-Antignac et al., 2008; Cahill and Ettarh, 2009; Boeckers et al., 2010; Leboulanger, 2011; Plaisant et al., 2009, 2011; Limbrecht et al., 2013; Williams et al., 2014; Martyn et al., 2014; Wei-Ting Tseng and Ya-Ping Lin, 2015; Boeckers and Boeckers, 2016). Indeed, it has even been suggested that teaching students using cadavers might be considered 'unethical' (McLachlan et al., 2004; McLachlan and Patten, 2006). Recently, Wisenden et al. (2018) have reported that undergraduate, pre-med students at their US liberal arts college also experienced anxiety as a response to cadaver dissection.

Plaisant et al. (2009, 2011) investigated whether negative reactions to dissection could be related to the students' personalities. Using 'The Big Five Inventory (BFI)' (Benet-Martinez and John, 1998; John and Srivastava, 1999; John et al., 2008), it was found that there is a relationship between personality traits and attitudes toward the dissection room, in particular levels of anxiety being positively correlated with negative affectivity. Reports are also available suggesting that anxiety in the dissecting room is greater amongst females

(e.g. Agnihotri and Sagoo, 2010; Plaisant et al., 2011; Anyanwu et al., 2014; Sandor et al., 2015; Boeckers and Boeckers, 2016).

Concerning the nature of the emotional response in medical students, Arráez-Aybar et al. (2004a&b, 2008) noted that there could arise a situation that students consider to be threatening but that novelty was the main characteristic. They also reported that dissection mainly evoked reactions of curiosity (89%) and interest (74%) before their first practical experience. Furthermore, while the sensation of uncertainty was experienced by a high percentage of students (69%) before the first session, uncertainty declined markedly once the students had completed their first dissection. It was noted that few students experienced anxiety (14%) or revulsion (17%) and that emotional reactions, including death anxiety, decreased as students gained more dissection experience. They concluded that the practice of anatomy with cadavers is an important 'professional training tool' in enabling students to come to terms with emotional reactions and attitudes in otherwise stressful clinical situations. On reviewing the literature, Boeckers and Boeckers (2016) similarly concluded that an 'ethical' anatomy course should use cadavers in order to further the development of medical competencies and to promote the maturation of young professionals.

While we have much information concerning the attitudes and responses of medical students to dissection in general, we have little knowledge of how specific regions are perceived. Robbins et al. (2008) and Duran et al. (2012) claim that students show greater emotional stress when they work on regions of the body that relate to the personality of the deceased or are intimate parts (e.g. face, perineum and hands). Furthermore, Segal (1998), taking an anthropological approach, report anecdotally that medical students show concern over dissecting the genitals, with males in particular balking at sectioning the penis. We also have no information about the attitudes and reactions to dissection of the students' teachers. In this study, we assess how students and professional anatomists react to different regions of the body, relating their responses to age, gender, cultural differences (comparing medical student cohorts from France and the U.K.), and their stated views regarding gender 'politics'. In terms of gender 'politics', the present study follows up previous investigations where we reported that attitudes and perceptions of sexism within anatomy could relate to attitudes to gender politics (Morgan et al., 2014, 2016, 2017).

Using a questionnaire provided to cohorts of medical students in France and the U.K. and to professional anatomists in the U.S. and Europe, we set out to test the following nine hypotheses:

1. that both students and anatomists display low levels of emotional responses to the use of cadavers and to most regions of the body;
2. that students perceive greater emotional reactions to dissecting the face and genital regions;
3. that, despite cultural differences, there are no differences in perceptions between the French and U.K. medical student cohorts surveyed;
4. that female students are more concerned than male students;
5. that younger persons show greater concern than older persons;
6. that students show greater concern than their teachers in anatomy;
7. that anatomists do not show greater emotional reactions to any specific region of the body;
8. that female anatomists are more concerned than male anatomists;
9. that students and anatomists who express positive political views relating to gender are more concerned than those who only express moderate views or negative views.

Methods

Second year medical students at Cardiff University and at the University of Paris Descartes, Sorbonne Paris Cité were provided with a questionnaire that assessed their reactions to dissecting different regions of the human body. In addition, and to provide comparisons, professional anatomists from Europe (particularly from the United Kingdom, France, Italy, and Spain) and the USA were invited also to complete the questionnaire. For the students, the questionnaire was provided as a hardcopy. For the anatomists, the questionnaire was available either electronically (Bristol Online Survey, BOS) or as a hardcopy.

Using Likert scales from 0 to 5, the students and anatomists were asked to rate their levels of concern about dissecting various parts of the body, where 0 indicates no concern and 5 indicates a high level of concern. The regions of the body assessed were: the face, the arm, the hands, the chest (male), the chest (female), the abdomen, the genitals (male), the genitals (female), the leg, the foot. The questionnaire also included questions to provide personal information (age, sex, etc.) and to rate their sympathy with gender politics. The questionnaire was approved by the ethics committee at the Cardiff School of Biosciences in accordance with procedures laid down by Cardiff University and by the regulating authorities at the University of Paris Descartes, Sorbonne Paris Cité. In addition, the principal author of this paper has completed the NIH Web-based training course "Protecting Human Research Participants (certification number 2841542). Accordingly, the survey was conducted anonymously, the data were strictly confidential, no vulnerable groups were included, and participation in the survey was voluntary and required written consent.

Fully completed responses were obtained from 220 students at Cardiff and 142 students at Paris (52% response rate) and from 208 anatomists (83% response rate). The two cohorts of students in Europe were employed in order to compare culturally different groups where, although anatomy teaching involves quite different pedagogic approaches, the students nevertheless demonstrate a high regard for the clinical importance of anatomy (see Moxham and Plaisant, 2007).

The data from the survey were entered in EXCEL spreadsheets. To compare statistically male and female responses, and also to enable comparisons between the data from Cardiff and Paris medical students, Student t-tests were employed. To compare data across the

groups of students and professional anatomists with different attitudes to gender issues, ANOVA was used and a least square difference (LSD) method was undertaken to enable post-hoc analysis. For questions where percentages were calculated, chi-squared tests were undertaken.

Results

Before considering the levels of concern for specific regions of the body, it was possible to aggregate data for all regions to provide an overall assessment. Given that for each of the 10 regions assessed the respondents were required to rate their levels of concern from 0 to 5, a maximum level would be scored as 50. Table 1 and Figures 1 and 2 summarise the findings for the overall levels of concern. These show that most students and anatomists had low scores (less than 20) with 27% of male students and 21% of female anatomists claiming no concerns compared with just 8% of female students and, with the least concern, 42% of male anatomists. Statistical analysis using t-tests showed that the students claimed to have more concerns than the anatomists ($p = 0.0000$). Furthermore, female students reported greater concerns than male students ($p = 0.0000$) and the French students declared greater concerns than the students in the U.K. ($p = 0.04$). When data for students and anatomists were combined, it was found that there were greater concerns amongst females ($p = 0.0000$). Indeed, for the anatomists, females showed greater responses overall ($p = 0.003$). Statistical analyses also showed that age is correlated with level of concern ($p = 0.0000$). However attitudes towards gender politics generally had little influence on the overall responses to anatomical dissection, no statistical differences being discerned whether the whole data were analysed or just the male or the female data. Nevertheless, from the point of view of the students, statistical differences could be determined between some student groups when male and female data are combined. Those students who were unsympathetic towards gender politics were significantly less emotionally inclined towards dissection and cadavers than those with neutral or positive attitudes (ANOVA, $p = 0.023$ for differences between negative and neutral attitudes and $p = 0.35$ between negative and positive attitudes).

For responses relating to specific regions of the body, Figures 3 to 12 provide radar plots for each region that show the reactions of the medical students and the anatomists. The 'slim' configurations of most of the radar plots suggest that there is, in the main, low levels of concern for most regions of the body. In addition, male anatomists were those who showed least variation and the most 0 scores (suggesting no concerns) while female students displayed the greatest variation and the least 0 scores. For all regions, more concern was expressed by the students than by the anatomists ($p = 0.0000$) and, when data for students and anatomists were combined, females claimed to be more concerned

than males ($p = 0.0000$). Table 2 provides a rank order for the regions in terms of the responses for different groups of respondents.

For the face (Figure 3 and Table 2), this region showed the greatest level of concern. In addition to the female students showing more concern for this part of the body ($p = 0.0000$), female anatomists also claimed more concern than male anatomists ($p = 0.001$). When data for students and anatomists were combined, differences were seen for those with differing views on issues relating to gender politics. Those with negative attitudes towards gender issues were less concerned than those who had neutral or positive attitudes ($p = 0.0000$ comparing negative and neutral attitudes; $p = 0.031$ comparing negative and positive attitudes). These differences were also found when data for female and male students were combined ($p = 0.002$ comparing negative and neutral attitudes; $p = 0.023$ comparing negative and positive attitudes). No differences were discerned between the French and U.K. students.

For the arm (Figure 4 and in Table 2), there are very low levels of concern, but with female students again being more concerned than male students ($p = 0.0000$). However, no statistical differences were found between female and male anatomists, between French and U.K. students, and with respect to attitudes towards gender issues.

For the hands (Figure 5 and Table 2), this region showed some concern compared with most other regions. Furthermore, both female students and female anatomists expressed more concern than their male counterparts ($p = 0.0000$ and $p = 0.024$ respectively). No differences were found for those with differing attitudes towards gender issues or when comparing students in France and the U.K.

For the chest (male) (Figure 6 and Table 2), there are low levels of concern. Nevertheless, female students expressed more concern than male students ($p = 0.045$) and French students were more concerned than U.K. students ($p = 0.0000$). No statistical differences were discerned between female and male anatomists. For anatomists, there were greater levels of emotional responses for those expressing positive attitudes towards gender issues than those with negative attitudes ($p = 0.032$).

For the chest (female) (Figure 7 and Table 2), this region presented a higher level of concern than for the chest (male). Female students were more concerned than male students ($p = 0.0000$) with French students also more concerned than U.K. students ($p = 0.001$). There were no statistical differences between female and male anatomists nor between those with differing attitudes towards gender. Furthermore, female students were not more concerned than male students.

For the abdomen (Figure 8 and Table 2), this part of the body showed relatively low levels of concern. Female students recorded greater concern than male students ($p = 0.021$) with French students expressing more concern than U.K. students ($p = 0.002$). Female anatomists were also more concerned than male anatomists ($p = 0.015$), but no differences for either students or anatomists were found in relation to attitudes towards gender issues.

For the genitals (male) (Figure 9 and Table 2), this region showed relatively high levels of concern. No statistical differences were discerned between female and male students or anatomists and also in relation to gender issues.

For the genitals (female) (Figure 10 and Table 2), there was a relatively high level of concern. In addition, female students were seen to be more concerned than male students ($p = 0.0220$). Female anatomists were also more concerned than male anatomists ($p = 0.013$). No differences were found in relation to attitudes towards gender issues.

For the leg (Figure 11 and Table 2), this part of the body showed the lowest level for concern. Nevertheless, female students were seen to be more concerned than male students ($p = 0.005$) with female anatomists also more concerned than male anatomists ($p = 0.006$). No differences were again found in relation to gender issues.

For the foot (Figure 12), there are low levels of concern. However, Table 2 suggests that this region is midway in the ranking order of regions. In addition, female students were found to be more concerned than male students ($p = 0.0000$) and also female anatomists more concerned than male anatomists ($p = 0.05$). No differences were found in relation to gender issues.

With respect to those with different attitudes to gender issues, although as indicated above some statistical differences were discerned for some regions, overall there were no significant differences when comparing female and male anatomists or female and male students.

Discussion

The teaching of anatomy by means of dissection has been regarded as fundamental since the Renaissance (Malomo, 2006; Moxham and Plaisant, 2014; Ghosh, 2015). However, dissection by the students has only relatively recently been possible following legislature that permitted sufficient cadavers for their education. In this respect, dissection by anatomists in order to demonstrate to students is the 'traditional' way of teaching anatomy and dissection by the students themselves is 'modern' (Moxham and Plaisant, 2014; Moxham and Pias, 2017). Even so, dissection is regarded by some as being unnecessary (e.g. McLachlan and Patten, 2006) and, in consequence, worldwide there have been in recent times significant cuts to the time allotted for teaching anatomy (e.g. Collins and Given, 1994; Drake et al., 2002, 2009, 2014; Ramsey-Stewart et al., 2010; McBride and Drake, 2018). Despite the fact that medical students, medical graduates, anatomists, medical practitioners and laypersons consider dissection to be a very important part of the medical course (Pabst and Rothkötter, 1997; Patel and Moxham, 2006, 2008; Hofer 2006; Moxham and Plaisant, 2007; Moxham and Moxham, 2007; Körf et al., 2008; Boeckers et al., 2010; Kerby et al., 2011; Duran et al., 2012; Olowo-Ofayoku and Moxham, 2014; Moxham et al., 2016b, 2017; Pais et al., 2017; Flack and Nicholson, 2018), a variety of reasons have been given for removing anatomical dissection from the curriculum, including the time allocation, constraints on financial and human resources, difficulties in obtaining suitable donations, problems of breaking a taboo related to death, risks of infection, unpleasant working environment, and Millennials' preferences for using digital technologies for their learning (e.g., Strauss and Howe, 2000; Meriac et al., 2010; Twenge (2014)). This is not the place to discuss all these matters *in extensuo* but it should be stated that the authors reject the argument that emotional reactions to the dissecting room experience are contrary to good ethical practice and the development of caring health professionals as suggested by McLachlan et al. (2004) and McLachlan and Patten (2006). This issue is discussed later.

Emotional responses to the dissecting room experience can take various forms; for example, anxiety, stress embarrassment, misgivings about educational validity or about morality, thoughts about death. In this study, we were unable to drill down to the causes of the emotional responses when concerns were acknowledged by the students and this will have to form the basis of future studies. However, we found that the students' concerns

were low-key. Furthermore, in our previous study (Plaisant et al., 2011) we reported that curiosity was the main reaction, with only 8% of the medical students being initially so anxious that they rejected the dissection environment. This accords with the assertion of Arráez-Aybar et al. (2004a&b, 2008) that novelty was the main response to the dissecting room experience. They further reported that, before the first experience, students expressed curiosity and/or interest (89% and 74% respectively).

Concerning our **first hypothesis**, we conjectured that both students and anatomists display low levels of emotional responses to the use of cadavers and to most regions of the body. Our findings are consistent with this hypothesis and accords with previous studies on this topic for students. For example, Arráez-Aybar et al. (2004a&b, 2008) reported that less than 14% of medical students reported negative emotional responses on first being presented with human cadavers (see also the Introduction for references). Plaisant et al. (2011) reported that, in terms of personality, only medical students who expressed strong negative affectivity (neuroticism) maintained strong emotional reactions to seeing cadaveric material. It could be argued that students who have personalities with high levels of negative affectivity are not suitable for pursuing a medical career and it is unfortunate that most admission criteria rely on academic achievement and do not take into consideration fitness for practice on the basis of personality. Furthermore, there is the assumption from many of those who have investigated emotional responses to cadavers that 'anxiety' is to be avoided. Undoubtedly, extreme anxiety is not to be countenanced but, not just in life, in medical practice each new experience brings some anxiety that is a preparedness for performing at acceptable levels. The analogy is of the actor (or even lecturer) who, if not slightly nervous on facing her/his audience, is unlikely to give of her/his best. Medical students are not to be 'wrapped in cotton wool' but guided judiciously towards attitudes and behaviours appropriate for a demanding and important profession.

Gupta et al. (2011), supported by Brenner and Pais (2014), suggested that today's medical practitioners could be seen to lack compassion and empathy. In addition, Sandor et al. (2015) have suggested that an "emotionless approach" to dissection could be associated with "an over-reserved attitude that might carry over to the later doctor-patient relationship" (see also Charlton et al., 1994). Brenner and Pais (2014) recommend that the introduction of medical humanities courses might help 'humanise' the dissecting room experience. Based upon our findings, we would support this notion.

Our **second hypothesis** proposed that medical students perceive greater emotional reactions to dissecting the face and genital regions. Our findings support this hypothesis but it should be borne in mind that this is in the context of there being general low levels of emotional responses. That the face elicited more responses suggests that initially the students readily personalise the cadaver and do not see it as being merely an educational 'tool'. In our opinion, this is to be welcomed since it is often said by anatomists that the cadaver should be regarded by the students as their 'first patient'. We recognise that young students may not easily get to grips with this concept and there may be something to be said for the view that, prior to attending the cadaver, the students should be primed for the experience, perhaps even with them being given the personal history of the donor. That the genitals also provoke a greater emotional reaction is unsurprising, despite sexual attitudes being more liberal in contemporary Western societies. Similar attitudes might explain the slightly greater reactions shown by medical students to the female chest. Recent concerns about sexual harassment and bias in contemporary society should alert anatomy teachers to the need to be vigilant about the existence of sexism (reported by Morgan et al., 2014, 2016, 2017; Parker et al., 2017). That the hand also was associated with a slightly greater emotional response is more difficult to explain, although this finding supports anecdotal evidence circulating amongst anatomists. Perhaps, like the face, the hand psychologically personalizes the cadaver. In relation to attitudes to intimate parts of the body, finding strategies and learning to cope with emotions relating to taboo areas might prepare medical students for doctor-patient encounters, including internal examinations and contact. Whether living anatomy tuition could help with these issues is debatable given the reluctance in some courses to have mixed tutorial groups and the taboo of including internal examinations.

For our **third hypothesis**, we suggested that, despite cultural variances, there are no differences in perceptions between the French and U.K. medical student cohorts surveyed. However, our findings were not consistent with this hypothesis since French medical students declared greater emotional responses than the U.K. medical students. We must consequently be mindful that cultural difference might play a part in how the dissection room experience is introduced. Indeed, there is evidence that religious beliefs influence reactions to the cadaver (Martyn et al., 2014). Furthermore, Wisenden et al. (2018) have reported that non-white, non-Christian students on their undergraduate pre-med course are

more likely to experience long-term anxiety as a response to cadaver dissection. This could relate to different cultural or religious views concerning the 'sanctity' of the body and/or be related to general issues relating to being in a foreign country and with the pressures and financial problems that can relate to being away from their homebase.

In relation to our **fourth hypothesis**, based upon previous studies (e.g. Agnihotri and Sagoo, 2010; Plaisant et al., 2011; Anyanwu et al., 2014; Sandor et al., 2015; Boeckers and Boeckers, 2016), we proposed that female medical students show more emotional responses than male students. Indeed, our findings support this notion (although females may be more prepared to admit and divulge their emotional reactions, Sandor et al., 2015). In our previous study (Plaisant et al., 2011) we found that female students preferred observing a dissection rather than dissecting for themselves. In our paper on sexism (Morgan et al., 2014) we cited female students' reports of negative experiences in the Dissecting Room. To provide two examples:

"One of the retired surgeons who demonstrated in the DR made it clear he felt the female students were less capable of dissection than male students and would address all his questions to the boys despite girls volunteering correct information on a regular basis."

"I felt right at the start that the boys in my group thought we'd be too 'scared' to dissect."

In this study, with the exception of the male genital region where there was equal concern from both female and male students, the female students showed greater concern than their male counterparts for all regions of the body. The question should be posed whether particular attention should be paid to the reactions of the female medical students. Although there might be some advantages in having dissecting teams consisting only of female students, a mixed team is perhaps preferable, provided that sexist attitudes as reported by Morgan et al. (2014) are not countenanced. One could also argue that particular attention should be paid to the male students to get them to reflect more positively on equality issues.

In terms of the age of the medical students, for our **fifth hypothesis** we suggested that younger students show greater concern than older students. However, our findings are not consistent with this hypothesis. Our **sixth hypothesis** stated that medical students show

greater concern than their anatomy teachers in anatomy and this is supported by our findings. In interviews we conducted to ascertain attitudes towards the body the following two comments are worth reporting to show that examples of anatomy teachers being more sensitive than students to some regions of the body can exist:

When dissecting a penis, an older (male) anatomist was offended that a young female was doing it. He asked her to get a modesty towel;

An anatomy professor (circa 2009) used to insist that life-drawing models in his courses should wear swimming costumes because he felt it wasn't appropriate for medical students to see nudes.

As far as we ascertain, no previous studies reporting the emotional responses of professional anatomists have been published. Perhaps not unexpectedly, the anatomists not only showed less emotional responses than the students but they also did not show any differential responses to different regions of the body. Thus, consistent with our **seventh hypothesis**, unlike the students their teachers were unconcerned about the face, genital regions, hands and female chest. However, as for the students, there were slightly more concerns from the female anatomists than the male anatomists, thus being consistent with our **eighth hypothesis**. It could be argued that long-term exposure to dissecting has blunted the emotional responses of the anatomists. However, many of the anatomists were relatively young. Consequently, we would propose that the differences between the medical students and the anatomists relates more to vocational reasons since anatomists have chosen this discipline for their careers. It might also be proposed that the anatomists are more aware of the clinical importance of the discipline, although studies on the attitudes of medical students clearly show that they are fully cognisant of the clinical relevance of gross anatomy (Moxham and Plaisant, 2007; Moxham and Moxham, 2007; Kerby et al., 2011; Olowo-Ofayoku and Moxham, 2014). It is expected that anatomists are aware that the medical students have different sensitivities so that they can best deal with any issues relating to students' emotional responses.

Finally, and in relation to the **ninth hypothesis**, we proposed that both medical students and anatomists who express positive political views relating to gender are more concerned about the dissecting room experience than those who only express moderate or negative

views. In our previous studies (Morgan et al., 2014, 2016, 2017), we found significant differences in attitudes and experiences relating to anatomy depending upon gender political issues. It was because of this finding that we hypothesised that gender politics could impinge upon the dissecting room experience. In the main, however, our findings are not entirely consistent with this hypothesis, although students, but not professional anatomists, who had negative attitudes towards gender issues were less emotionally inclined towards dissection and cadavers in general terms than those with neutral or positive attitudes. We do not have an explanation for this finding but we should record that in the 1990s female professional anatomists in the US produced a programme of tuition that integrated gender awareness with anatomy in the medical curriculum (interview with Kathryn Peek, 2017). Such ventures were short-lived because of lack of institutional support.

For specific regions of the body, surprisingly, female anatomists who expressed sympathetic views towards gender issues appeared more concerned about the male chest than those who had little or no sympathy with gender issues. Furthermore, those anatomists and students sympathetic to gender issues claimed to have greater emotional reactions to the face. Explanations for these results are not presently clear but we propose that the concerns relate not to any feelings of anxiety or abhorrence but to an empathy that derives its sensitivity from the liberality that comes from having regard to equality and diversity issues.

Recommendations

We recommend that, at the start of an anatomy dissection course, time is spent dealing with sensitive issues (including equality and diversity issues), emotional responses, and matters pertaining to mortality. However, this should not involve hiding regions of the body, nor overreacting to the natural anxiety of students, since doing either of these things could enhance negative reactions and stifle the progress of the student from being a layperson to a competent healthcare professional. Although, as mentioned in the Introduction section, the use of cadavers for the teaching of anatomy is under a critical gaze, including the notion that it may be 'unethical' to teach young medical students using dissection (McLachlan et al., 2004), we take the contrary view that not to use cadavers verges on the unethical since, in addition to denying students the best pedagogic approach to learning anatomy (see also

Moxham and Pais, 2016, 2017), students are entering a profession where it is necessary for them to encounter, and reflect upon, medical and sociological matters that are not always pleasant and may even be regarded as taboos by the rest of society. To further the argument, perhaps too much attention is paid to the feeling of 'anxiety' that is often experienced by students before their first dissection. Anxiety, if not extreme, is not a bad thing for it is indicative of a sensitive approach from the students that steels them for the tasks ahead. Students, if they are to develop professional competency, should not be wrapped in cotton wool! What good healthcare worker is not slightly anxious when faced for the first time with a difficult procedure or clinical case? The question remains, what does a teacher do when faced with extreme cases of anxiety or emotional response? Clearly, sympathetic handling, rational argument and time might ameliorate the adverse responses. However, if persistent then, given that this might affect clinical competence, there could be issues of fitness for practice. This might appear a rather harsh attitude but laypersons (potential, and real, patients) and society in general are the consumers of medicine and require clinical competence (Moxham et al., 2016b). It has become practice in some situations to provide students with 'trigger alerts' when sensitive issues are about to be dealt with in class. While we would support the use of such alerts if handled appropriately, we nevertheless are concerned that they might unnecessarily increase emotional responses and foster taboos. Finally, we would echo the words of Segal (1988) who, emphasizing that emotional experiences must be managed unemotionally, stated: "The students view this positively, as replacing cultural taboos with rational enlightenment". Our task, as anatomists, is to ensure that this positive notion is not undermined by the negativity that could arise because of the risk of losing sensitivity and compassion.

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Figures and Tables

Table 1 Assessment of the 'total levels of concern' for dissection where scores for the ten regions of the body are aggregated (maximum score 50). The values given are percentages.

Total scores	Male students	Female students	Male anatomists	Female anatomists
0	27	8	42	21
1 - 9	26	27	41	44
10 - 19	30	28	13	24
20 - 29	6	23	2	11
30 - 39	9	11	2	0
40 - 49	2	2	0	0
50	0	1	0	0

Table 2 Mean scores assessing levels of concern for dissection (range 0 to 5) for the 10 regions of the body. The table places the regions in order of the level of concern for each of the groups involved in the survey.

All females	All males	All Students	FR students	UK students	Anatomists
Face (2.54)	Face (1.36)	Face (2.43)	Face (2.54)	Face (2.37)	Face (1.35)
Genitals(f) (1.86)	Genitals(m) (1.35)	Genitals(m) (1.97)	Genitals(f) (2.1)	Genitals(m) (1.9)	Genitals(m) (1.06)
Genitals(m) (1.85)	Genitals(f) (1.21)	Genitals(f) (1.96)	Genitals(m) (2.09)	Genitals(f) (1.88)	Genitals(f) (0.94)
Hand (1.25)	Chest(f) (0.67)	Hand (1.24)	Chest(f) (1.49)	Hand (1.21)	Hand (0.94)
Chest(f) (1.09)	Hand (0.59)	Chest(f) (1.2)	Chest(m) (1.35)	Foot (1.1)	Abdomen (0.42)
Foot (1.06)	Abdomen (0.56)	Foot (1.09)	Abdomen (1.34)	Chest(f) (1.03)	Chest(f) (0.41)
Abdomen (1.04)	Chest(m) (0.54)	Abdomen (1.08)	Hand (1.29)	Abdomen (0.92)	Foot (0.33)
Chest(m) (0.94)	Foot (0.47)	Chest(m) (1.05)	Arm (1.08)	Chest(m) (0.88)	Chest(m) (0.28)
Arm (0.88)	Arm (0.39)	Arm (0.93)	Foot (1.06)	Arm (0.85)	Arm (0.22)
Leg (0.8)	Leg (0.36)	Leg (0.86)	Leg (1.03)	Leg (0.76)	Leg (0.17)

Figure 1 Histogram displaying the 'total levels of concern' expressed by medical students. On the horizontal axis, 1 = students with 0 level, 2 = students with levels ranging from 1 to 9, 3 = students with levels ranging from 10 to 19, 4 = students with levels ranging from 20 to 29, 5 = students with levels ranging from 30 to 39, 6 = students with levels ranging from 40 to 49, 7 = students with maximum level of 50.

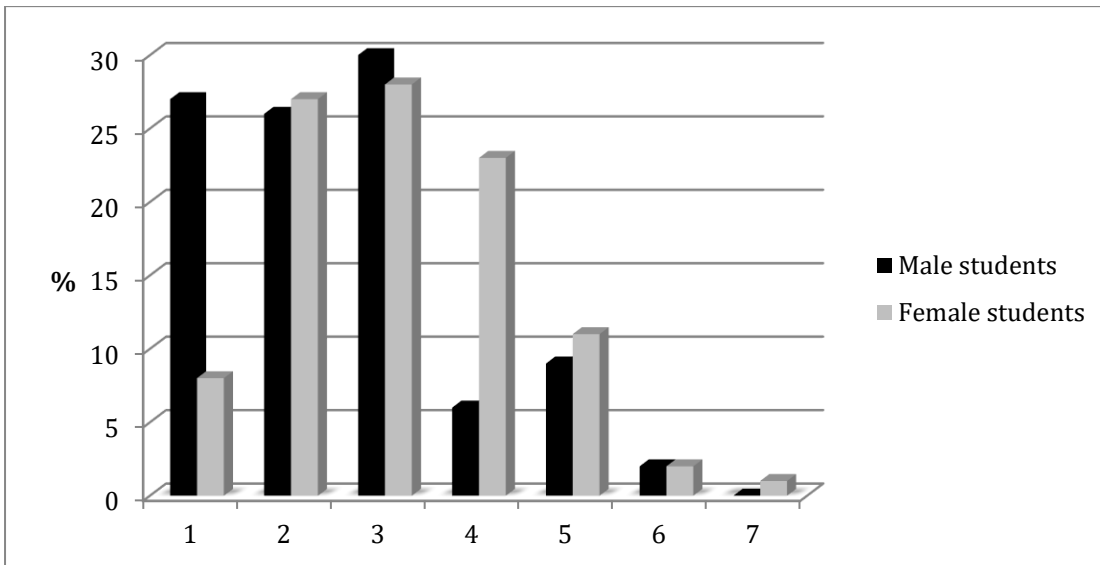


Figure 2 Histogram displaying the 'total levels of concern' expressed by anatomists. On the horizontal axis, 1 = anatomists with 0 level, 2 = anatomists with levels ranging from 1 to 9, 3 = anatomists with levels ranging from 10 to 19, 4 = anatomists with levels ranging from 20 to 29, 5 = anatomists with levels ranging from 30 to 39, 6 = anatomists with levels ranging from 40 to 49, 7 = anatomists with maximum level of 50.

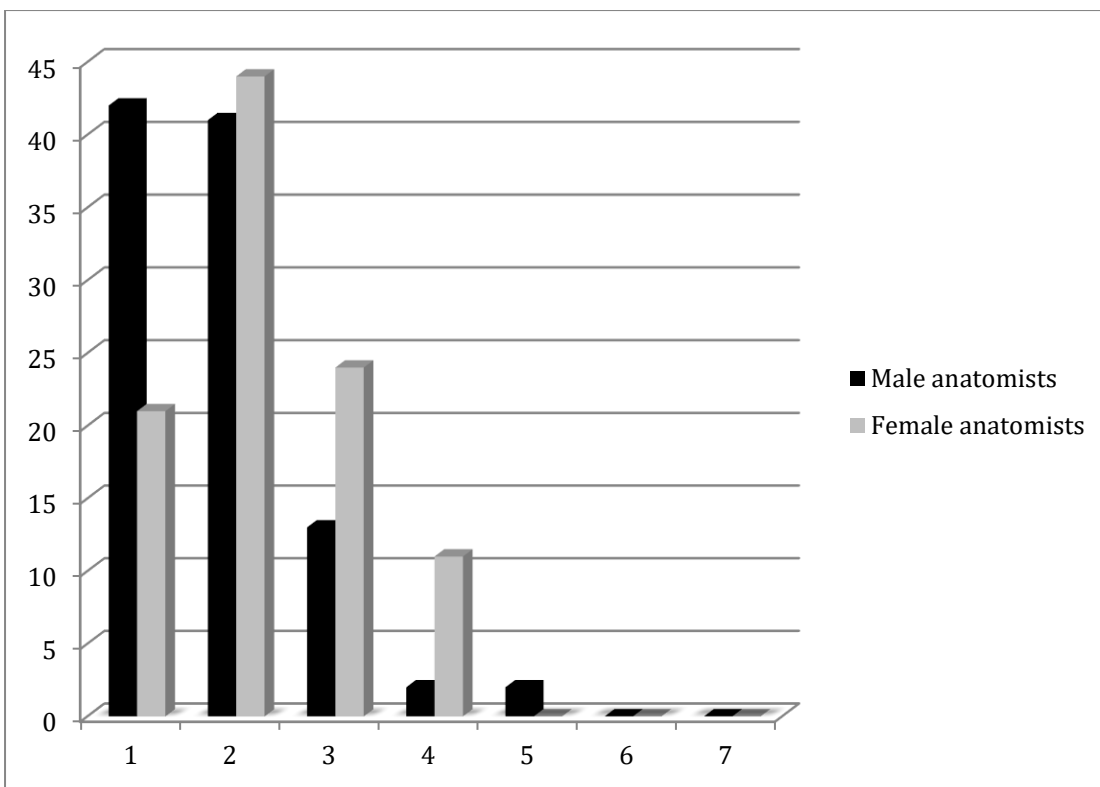


Figure 3 Radar plots illustrating emotional reactions towards dissection of the human face. Above – students; below – professional anatomists. Males’ reactions are indicated by the solid black lines and females’ reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

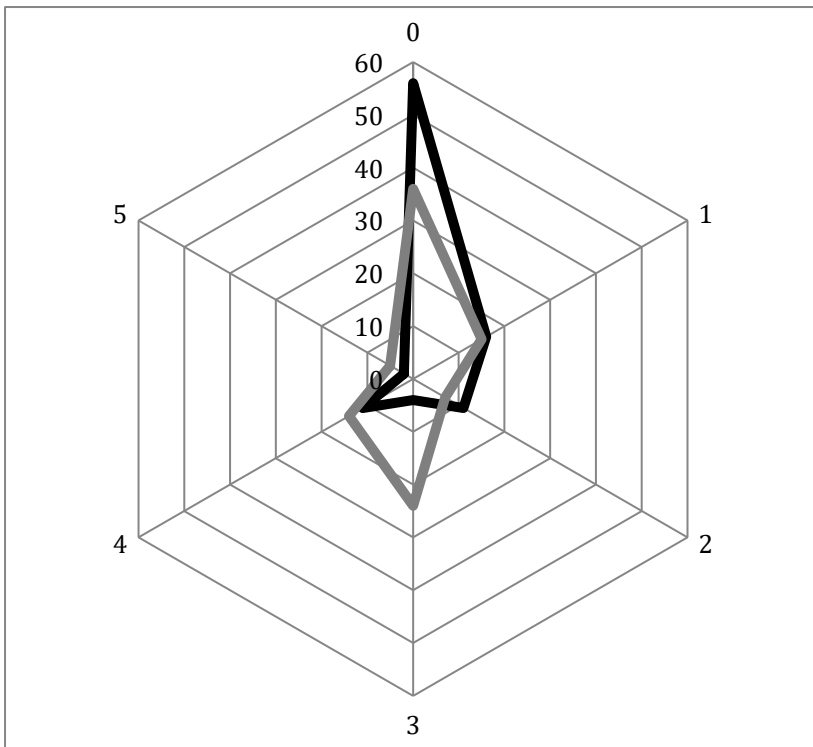
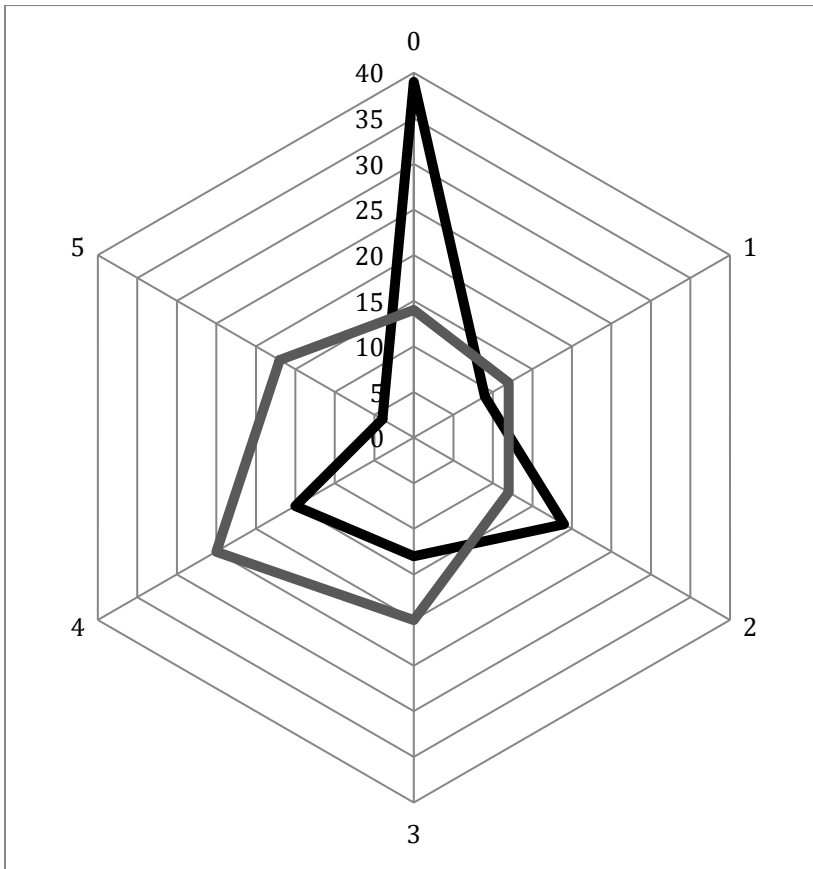


Figure 4 Radar plots illustrating emotional reactions towards dissection of the human arm. Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

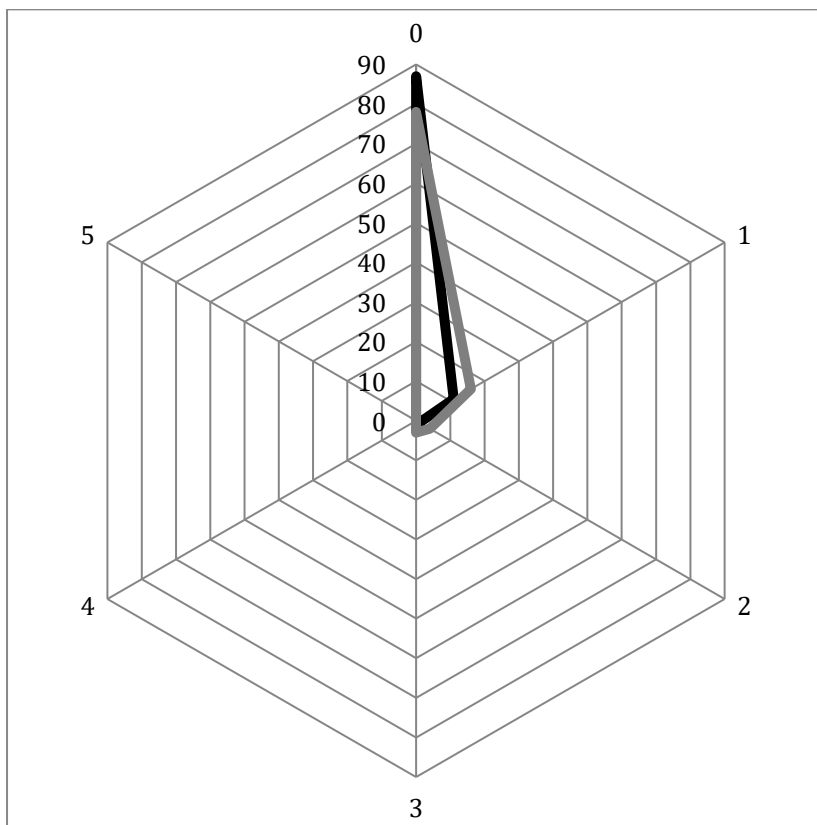
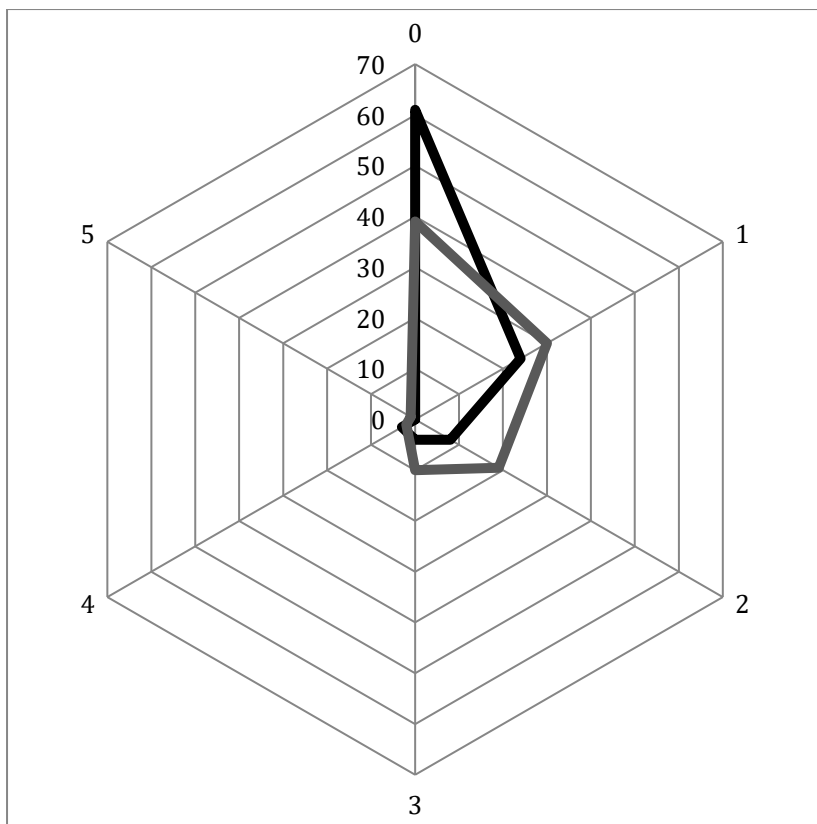


Figure 5 Radar plots illustrating emotional reactions towards dissection of the human hand. Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

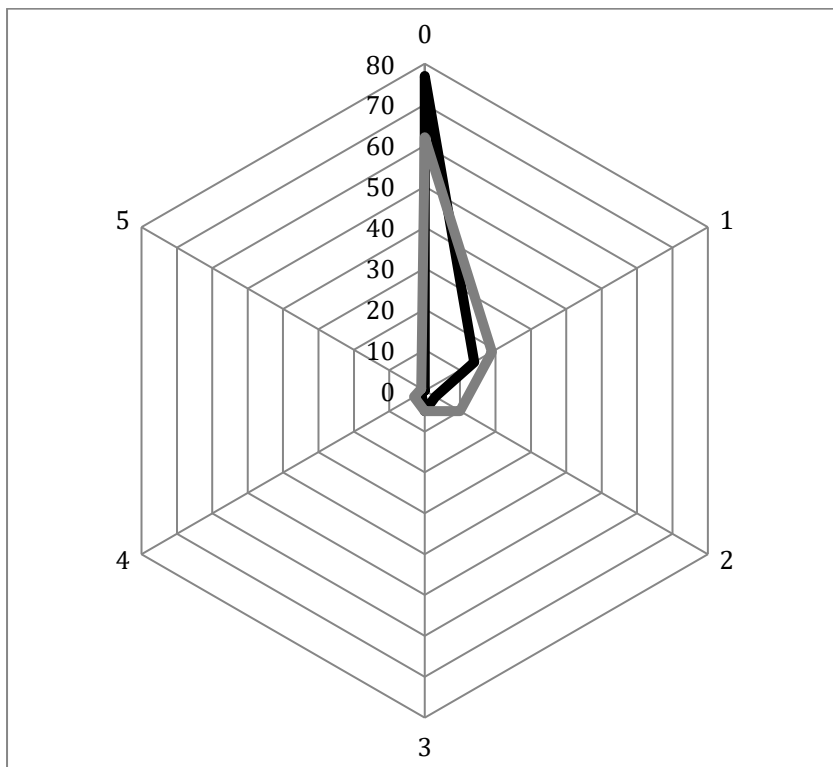
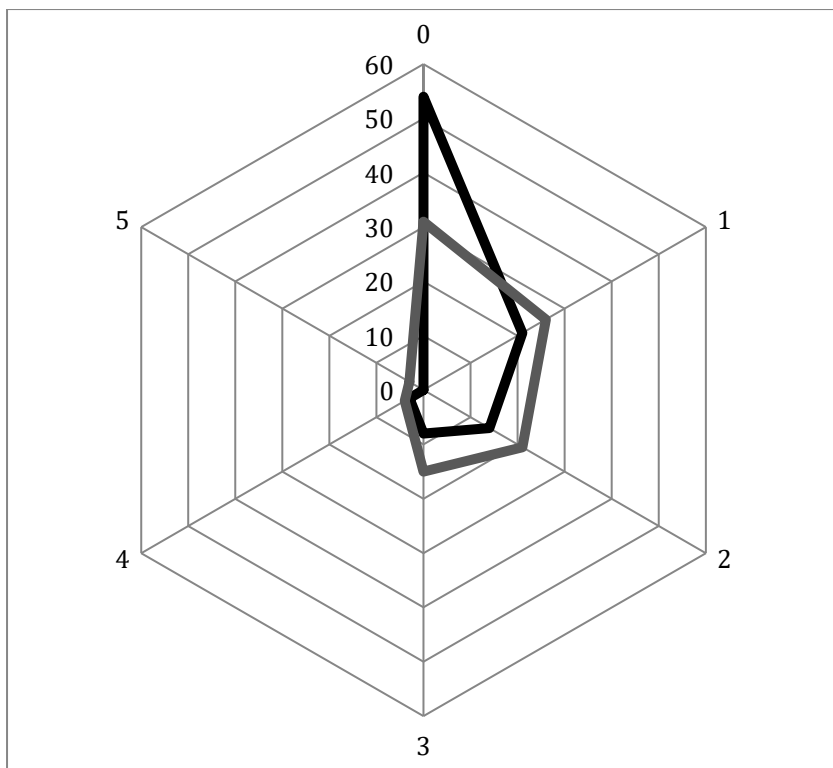


Figure 6 Radar plots illustrating emotional reactions towards dissection of the human chest (male). Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

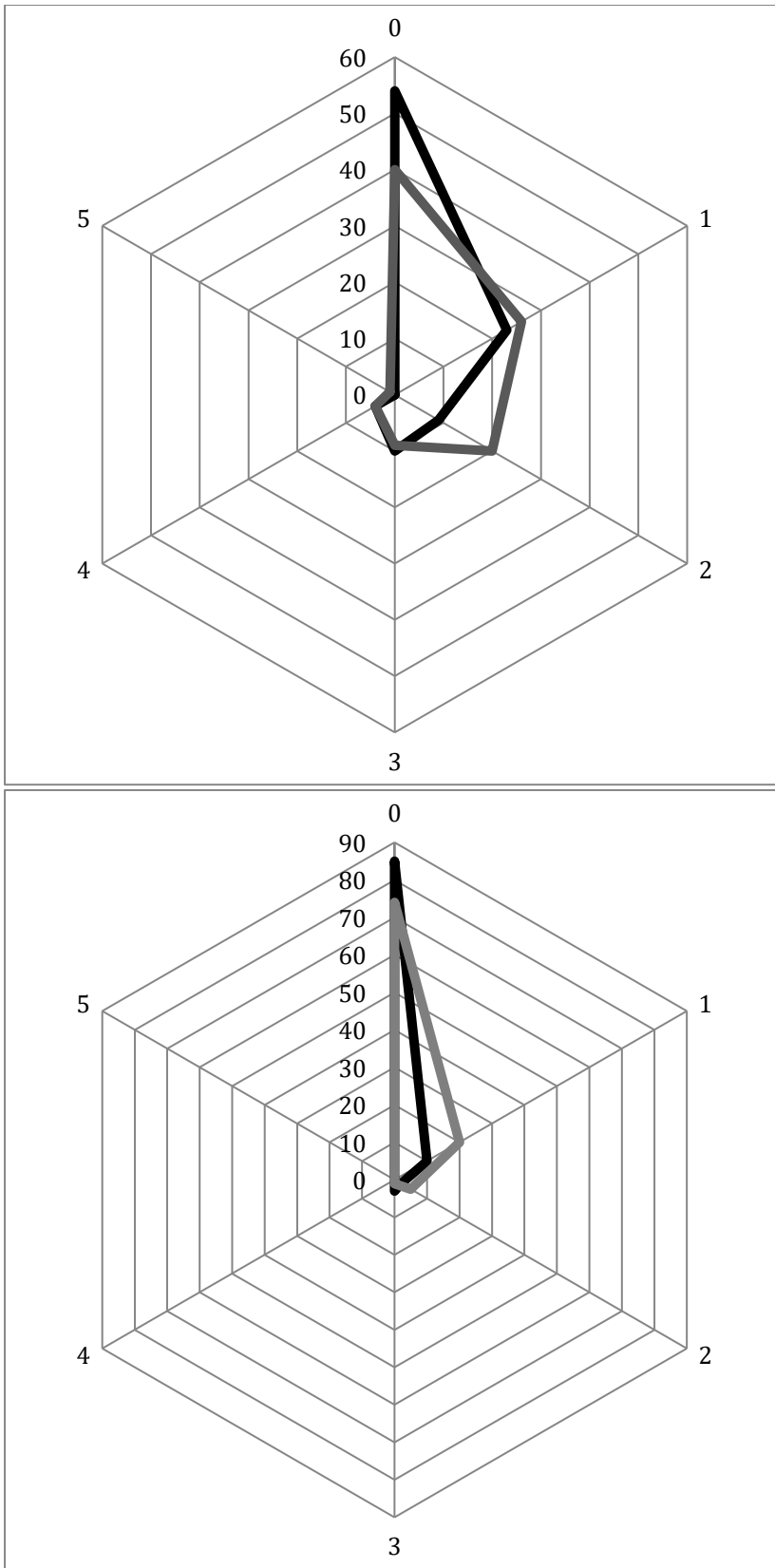


Figure 7 Radar plots illustrating emotional reactions towards dissection of the human chest (female). Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

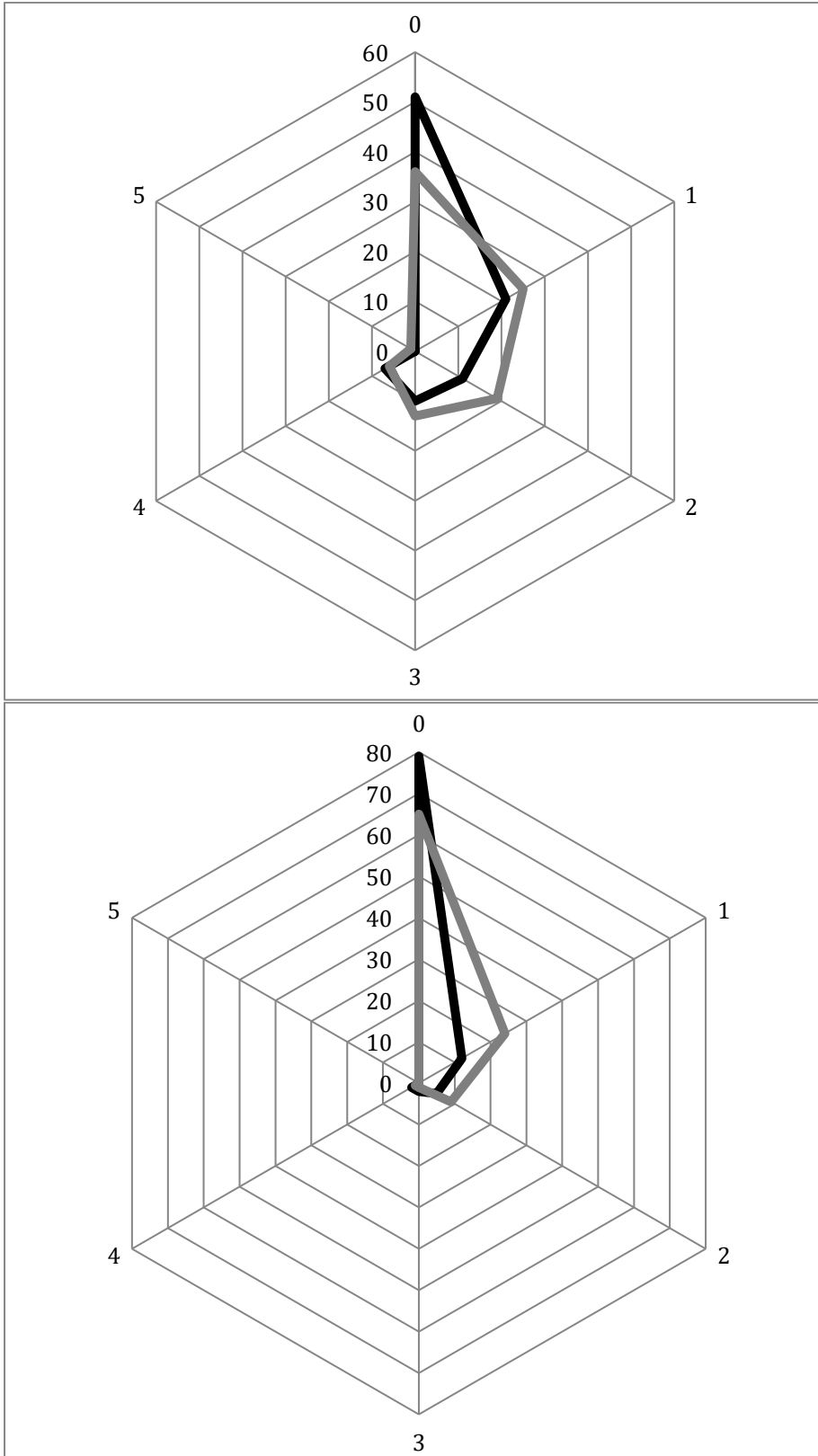


Figure 8 Radar plots illustrating emotional reactions towards dissection of the human abdomen. Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

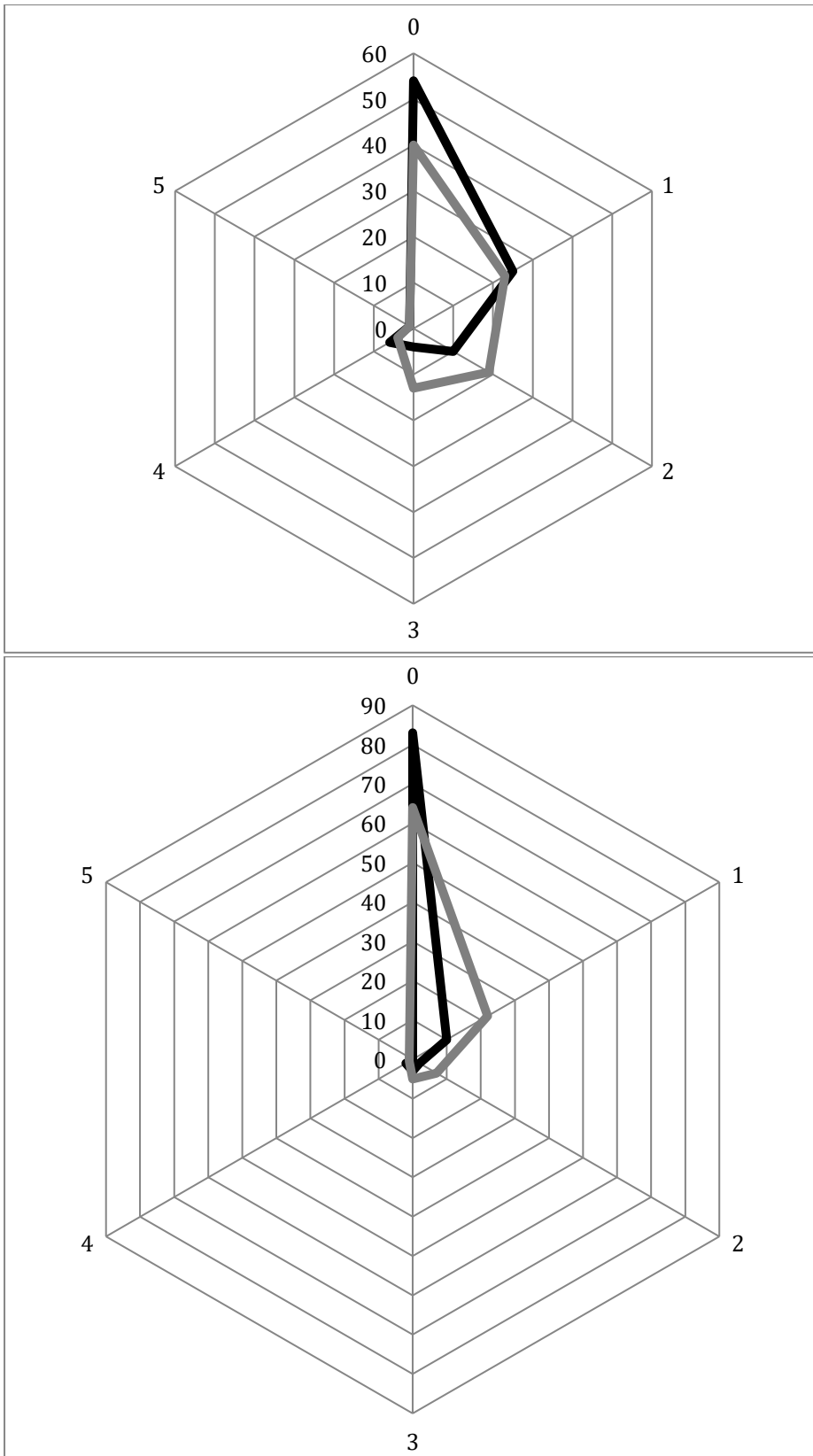


Figure 9 Radar plots illustrating emotional reactions towards dissection of the human genitals (male). Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

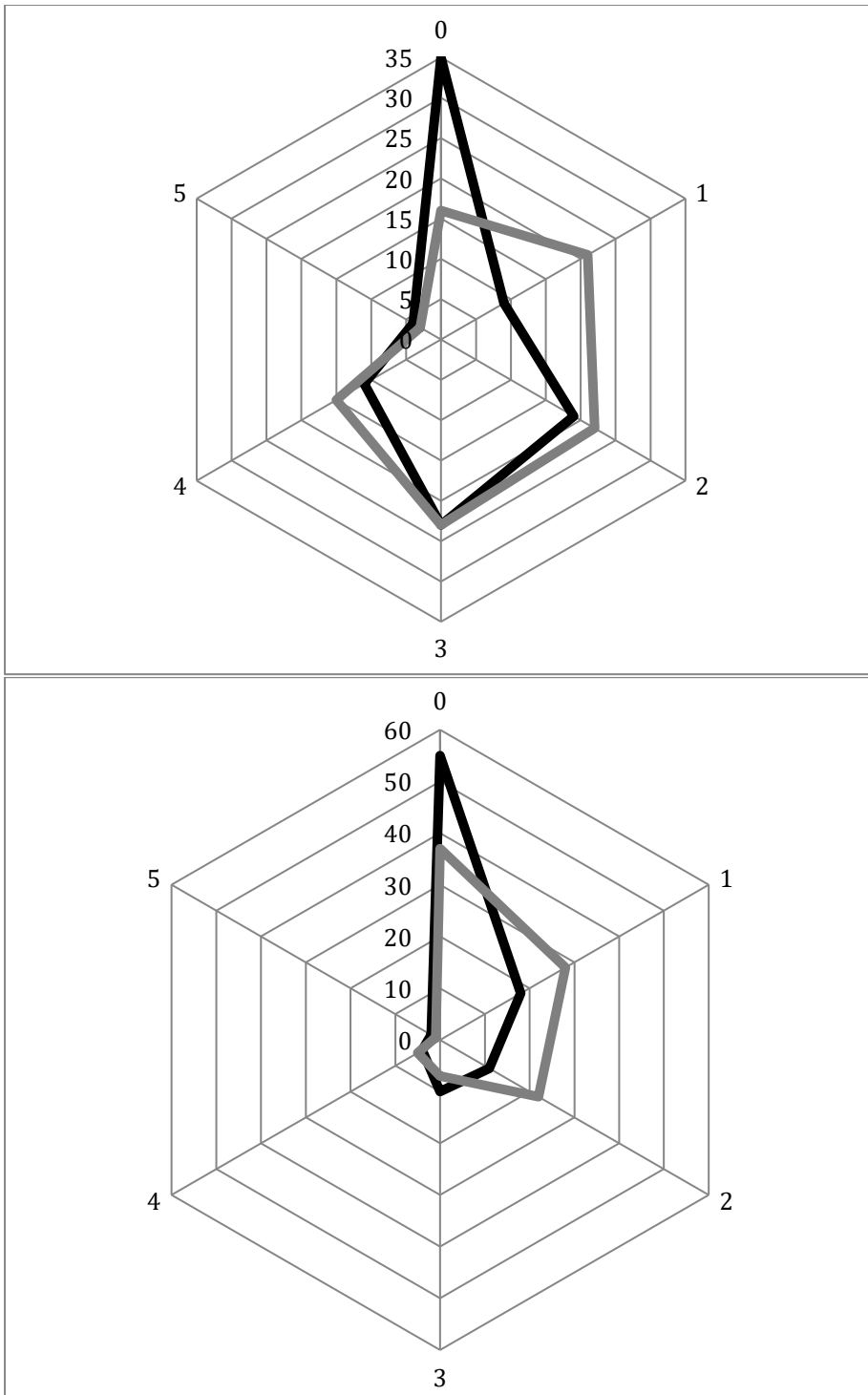


Figure 10 Radar plots illustrating emotional reactions towards dissection of the human genitals (female). Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

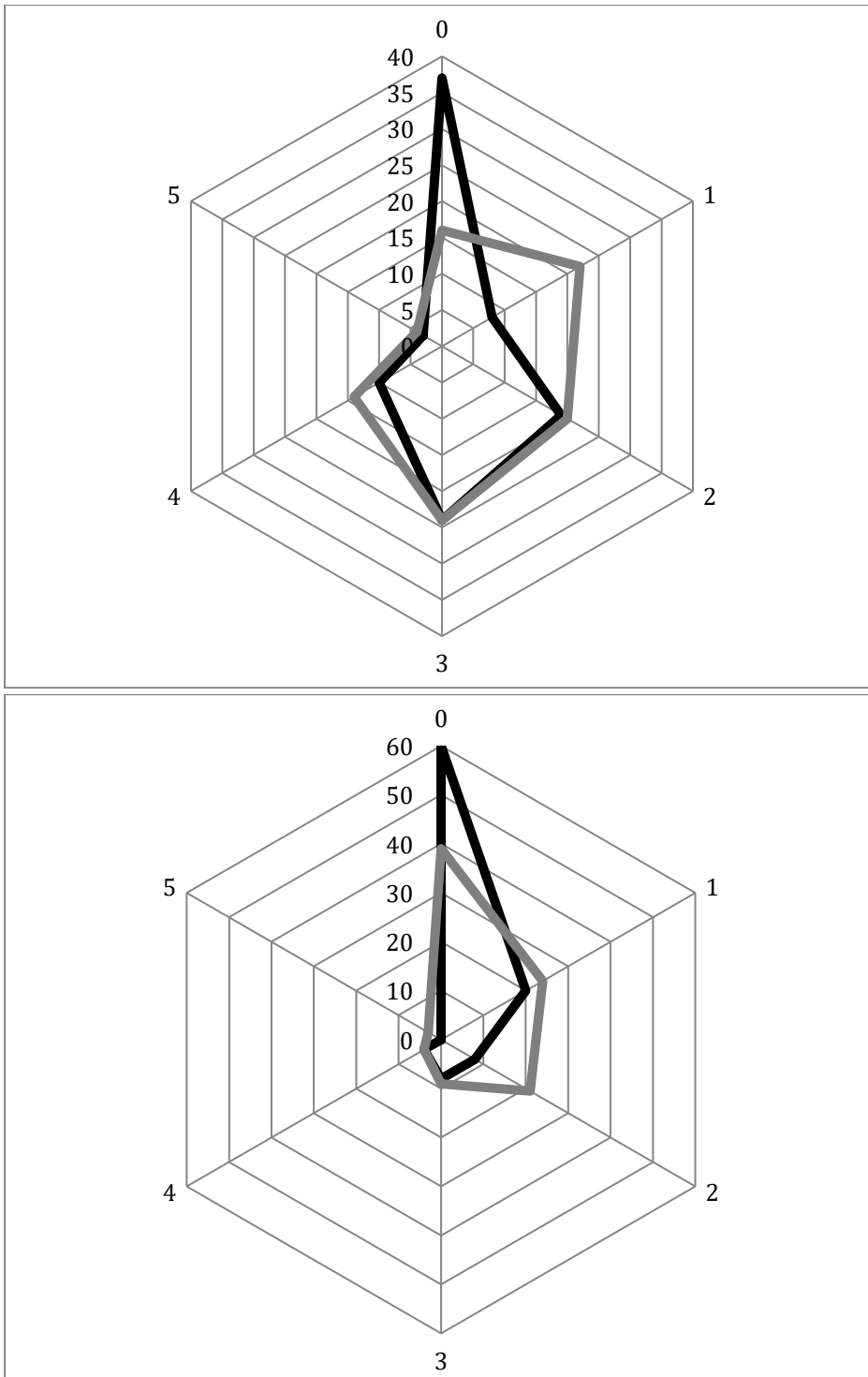


Figure 11 Radar plots illustrating emotional reactions towards dissection of the human leg. Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

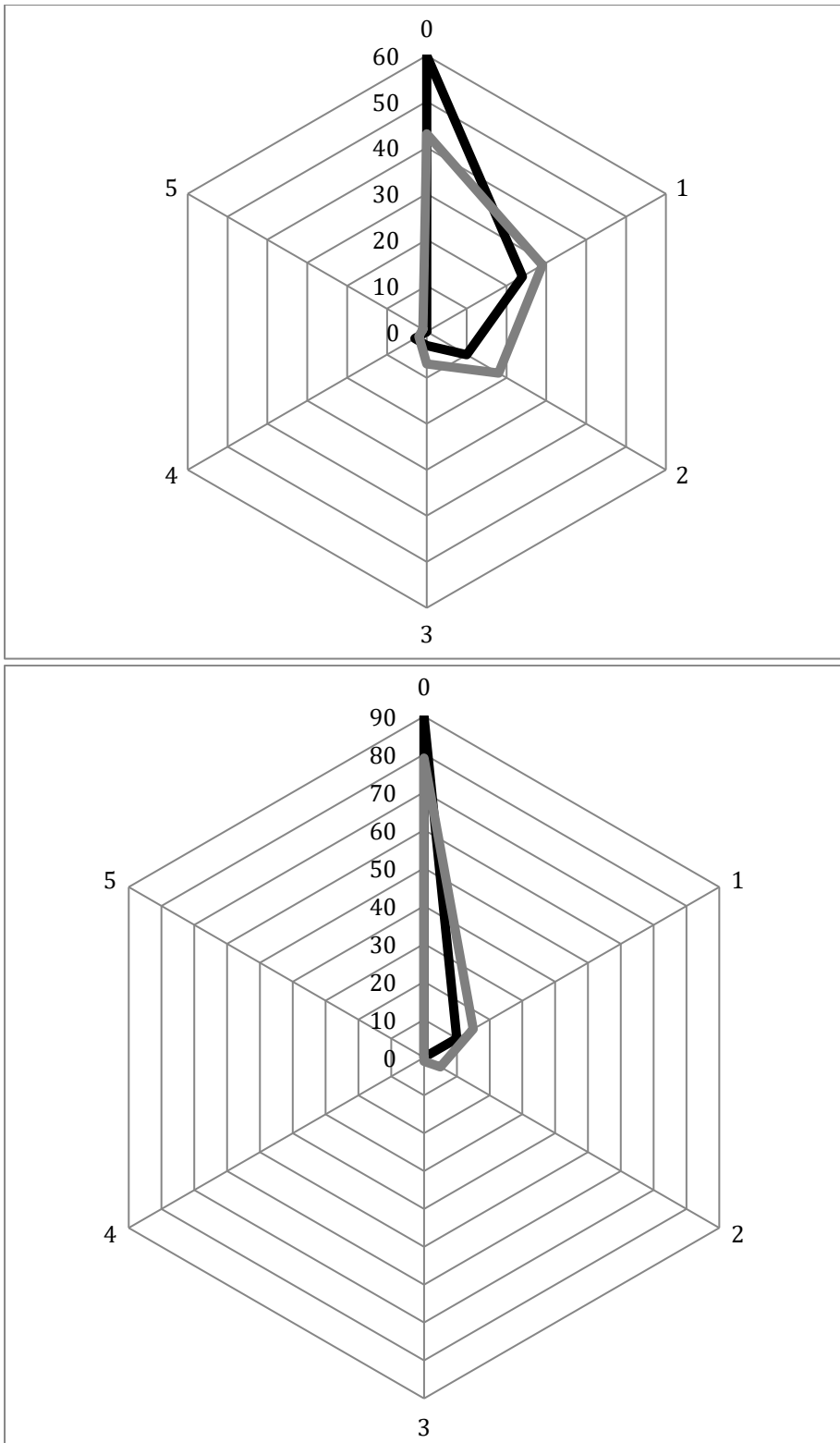


Figure 12 Radar plots illustrating emotional reactions towards dissection of the human foot. Above – students; below – professional anatomists. Males' reactions are indicated by the solid black lines and females' reactions by the solid grey lines. Scores 0 to 2 (above and to the right) suggest none to low negative reactions; scores 3 to 5 (below and to the left) suggest moderate to high negative reactions. The data are percentages and a narrow plot indicates little variation in the group.

