COMPARISON BETWEEN THE ADJUSTMENT AND STAIRCASE METHODS FOR EVALUATING BODY SIZE DISTORTION AND DISSATISFACTION

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Abstract

Body image is a multidimesional construct including both perceptual body size distortion and body dissatisfaction. In this study a comparison between the adjustment and staircase methods has been carried out on a sample of 137 participants (60 males and 77 females) in order to investigate body size distortion (both side and frontal profile). Concerning the cognitive component, questionnaires have been administred to assess body dissatisfaction. Results show that (i) the staircase method detects a greater distortion than adjustment method, (ii) in males sample, side profile has a greater distortion than frontal profile, and (iii) perceptual body size distortion and body dissatisfaction seem not to be related.

Since the 1990s the construct of body image has been extensively studied. According to Garner and Garfinkel (1981) body image is a multidimensional construct, which includes perceptual and cognitive aspects. Up to now most investigations seem to agree on dichotomising body image into a subjective dimension and a perceptual dimension (Sands, 2000).

The subjective component of body image has been described as dissatisfaction with one's body size, shape, or some other aspects of body appearance (Cash & Brown, 1987; Gardner, 2001), whereas the perceptual aspect refers to 'body size distortion' (Cash & Brown, 1987) and it involves inaccurate judgments of one's body size. Both dissatisfaction and body size distortion are recognised as important in their own right as well as in the development of eating disorders.

Research has employed psychophysical methodologies that allow for the separate measurement of perceptual and cognitive components in the measurement of body image. Traditionally, visual tasks are used to assess body size (whole body or specific body parts). These procedures include techniques such as the visual size estimation procedure (Ruff & Barrios, 1986) distorting mirror (Traub & Orbach, 1964), the video-distortion technique (Smeets et al., 1999), the life-size screen distortion method (Gardner & Bokenkamp, 1996), the silhouette method (Bell, Kirkpatrick, & Rinn, 1986) and more recently virtual reality (Alcañiz et al., 2000; Riva, 1998).

With respect to body dissatisfaction, usually investigators use questionnaires in order to assess constructs such as attitudinal and motivational factors as well as response bias (response bias occurs when previous beliefs or expectations alter how one interprets a situation).

In this research both perceptual and cognitive components have been studied; in particular, body size distortion has been analysed by comparing two psychophysical methods, the staircase and the adjustment methods, whereas the cognitive component has been studied through questionnaires assessing body dissatisfaction.

It is a well-known psychological fact that the threshold values and the point of subjective equality (PSE) depend in part on the method of measurement (Podlesek & Komidar, 2006).

With the psychophysical method of adjustment the participant is required to adjust the width of the image to match his or her perceived body size. Judgments include both ascending and descending trials, in which the image is initially distorted so as to appear too thin or too overweight. A body perception index is obtained by measuring the direction and degree of size distortion relative to actual body size.

According to Probst and colleagues (1992), when the participants use the method of adjustment, the initial body size that is observed works as an anchor that greatly influences the final size judgment. Research has shown that for those participants who are asked to decrease an initial image that is too broad, the final image that represents their body will be too broad, whereas as regards those participants who are asked to increase an image that is too thin, the final image that they judge as representative of their own body will be too thin. Although investigators take an average of the ascending and descending trials, Gardner and colleagues (1996) asserted that the result of this operation is an average body size judgement not accurately fitting neither the ascending nor the descending trials. In fact they (1996) found that the error of anticipation is not the same for ascending and descending trials, with estimates closer to actual body size occurring for ascending rather than descending trials. The problem of anticipation, probably because participants' attitudes and expectations affect their judgments about aspects of the stimulus (Gescheider, 1976), can be avoided by using a variant of the method of constant stimuli, wherein ascending/descending trials are not used, such as in the staircase method (Cornsweet, 1962).

The staircase method is an adaptative non-parametrical procedure used for the first time by Dixon and Mood (1948). In this procedure a stimulus is automatically increased or decreased until the "perceived" observer response is achieved. The observer is presented with a range of stimuli from those far below her or his actual size to those far above her or his actual size. For each trial one of these distortions is presented, and the participant is asked to report whether it represents an over- or an underestimation.

The result is the classical psychophysical function shown as a sigmoid shape, where the PSE represents the body size estimation. The PSE is defined as the size where the participant reported 50% of the images as overestimations and 50% as underestimations. In addition, this procedure allows one to ascertain how much distortion in body size beyond this PSE is necessary before the person detects the change as a just noticeable difference (JND). The main disadvantages of this procedure consists of the large number of trials at several different stimulus values and, therefore, in the time-consumption and burdensome for the participants (Gardner, 1996).

According to Cornsweet (1962) the staircase and adjustment methods are similar and equally efficient. Cornsweet noticed (1962) that the staircase method has the advantage that the specific value that the subject has experienced is known, whereas the adjustment method seems to be faster than the staircase method. Ehrenstein and Ehrenstein (1999) noticed that the adjustment method seems to be faster and simpler than the staircase method for experimental subjects, but it is known that the latter can estimate a more standardised threshold (therefore it is more precise and equiparable) because the staircase method does not allow the observer to control the stimulus directly. Accordingly, Gardner (1999) found that staircase and adjustment methods provide similar body image estimations. More recently, Podlesek and Komidar (2006) affirmed that, although these methods gave comparable results, the displacement obtained with the adjustment method is larger than the one obtained with the staircase method. Also, the variability of data differed between the methods, being greater for the adjustment method.

The aim of this study is a comparison between staircase and adjustment methods in evaluating body size perception and assessment of the relation between body size perception and body image dissatisfaction, both components referring to body image.

Method

Participants
The participants were 137 (60 males and 77 females), and mean age was 23.81 ± 1.83. Participants were volunteers, recruited from students of the University of Padua, Italy.

Apparatus
The *body size distortion programme* (Gardner & Boyce, 2004) works by using digitally stored images of participants (both side and frontal profiles) taken with a digital camera. After taking the images the experimenter chooses a psychophysical method.

Adjustment method: participants viewed their life-size image that was initially distorted to appear either too wide or too thin. The initial distortion level varied randomly from ±20% to ±30% of actual body size. By pressing buttons on a mouse, participants could vary the width of the body image, making as many adjustments as necessary until she/he believed that the image was an accurate representation of her/his actual body size. The participant adjusted the image by pressing the right or the left button on a mouse (the right button caused the displayed image's actual width to expand at the rate of 1% per second, whereas the left button caused the displayed width to decrease at the same rate). Holding down the middle button allowed the participant to confirm her/his adjustment.
The computer recorded the choice and then displayed another image. An equal number of randomly sequenced ascending and descending trials were used to control for errors of anticipation. The computer recorded the distortion present between the final adjustment and participants' actual size as a percentage of overestimation or underestimation.

Staircase method: the initial image was presented without any distortion. Immediately after appearing, the displayed image's width was sequentially decreased at a rate of 1% per second. When the participant believed that the body size displayed had reached her/his perceived actual size, s/he pressed the right button of the mouse. The direction of distortion was then reversed, and the participant instructed to press the left button when the image became equal to his/her perceived size. This 'direction reversing' continued until data measurement was complete.

Questionnaires: measures included Body Dissatisfaction (EDI-BD of the Eating Disorder Inventory (EDI 2; Garner, 1991) and the Body Shape Questionnaire (BSQ, Cooper et al., 1987).

Procedure
At the beginning of the experiment each subject was told that s/he would be participating in an experiment to assess body perception. Before starting the perceptual task, the experimenter took pictures of the participants' full frontal and full side profiles and then participants completed questionnaires while the experimenter prepared the computer program.

After a brief explanation and a training trial, participants were asked to perform the assigned tasks.

A mixed experimental design was used, including two within-subjects factors: Method (adjustment staircase) and Profile (frontal, side) for a total of 80 stimuli, and one between-subjects factor: Gender.
The experiment lasted about 30 minutes. The order of presentation of the Methods and the Profiles was counterbalanced among participants.

Results

For statistical analysis R software version 2.11.0 (R Development Core Team, 2010) was used.

Table 1. PSEs for both adjustment and staircase methods for frontal and side profiles. Standard deviations are shown in brackets.

	Frontal Adjustment	Frontal Staircase	Side Adjustment	Side Staircase
Male	-8.2658 (SD 6.7466)	-9.7334 (SD 5.8258)	-10.0032 (SD 7.7995)	-12.0639 (SD 7.1055)
Female	-8.8936 (SD 8.1712)	-10.6407 (SD 9.1381)	-7.4873 (SD 7.8357)	-10.0945 (SD 7.2931)
Total	-8,6187 (SD 6.992)	-10,2169 (SD 9.502)	-8,5157 (SD 7.583)	-10,9570 (SD 7.497)

Results of mixed ANOVA show that the main effect of Method is statistically significant ($F_{(1,132)} = 28.8442$; $p < 0.0001$), and the adjustment method produces a more accurate representation of actual body size than the staircase method (see Table 1).

The interaction between Gender and Profile is statistically significant ($F_{(1,132)} = 10.0891$; $p < 0.01$). No other statistically significant differences were found.

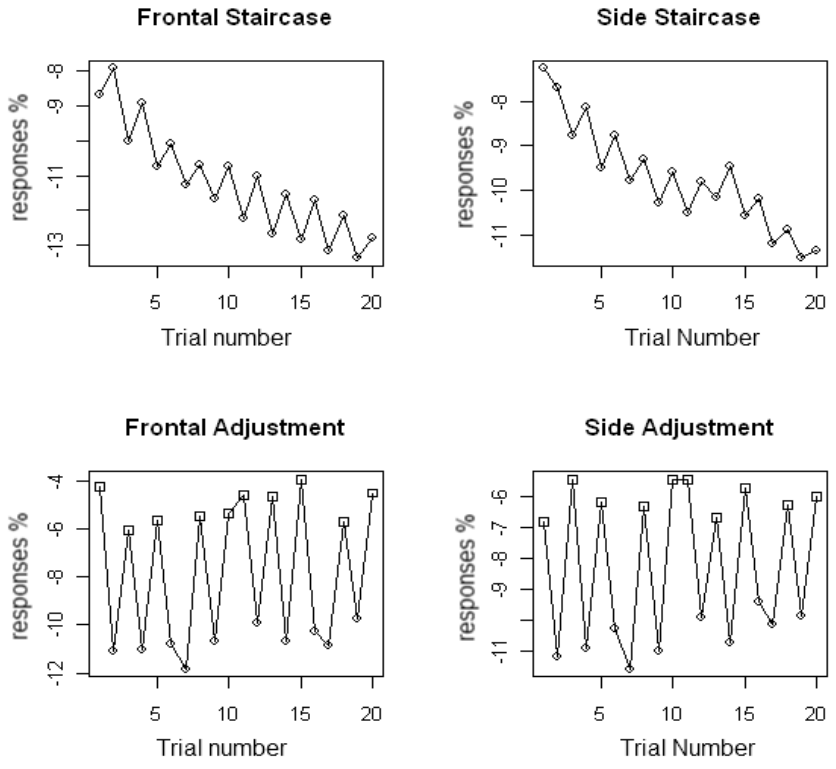

Figure 1. Percentages of responses averaged over subjects as functions of trials. The staircase method (frontal and side profile) in the upper side and the adjustment method and lower side. For the adjustment method circles represent responses in ascending trials, squares represent responses in descending trials.

Figure 1 displays the percentages of responses as a function of trial number for both methods.

In the staircase method it is possible to observe a constant descending trend through the PSE, whereas in the adjustment method the responses are constantly placed around the PSE.
Thus, a further ANOVA was performed to include Method (adjustment, staircase) and Trials (first ten trials, last ten trials). Results show a significant difference between the first ten and the last ten trials for the staircase method ($F_{(1,544)} = 2.4589$; $p < 0.0001$).

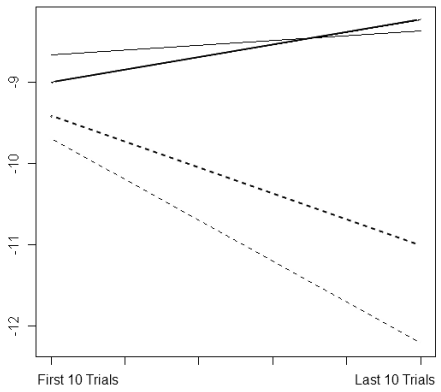

Figure 2. Means of responses for the first ten trials and the last ten trials for the staircase method (dashed lines) and adjustment methods. The dark (dashed) lines show Frontal presentations, the light lines Side presentations.

Relations between questionnaire score and body distortion
Finally, the relation between body size distortions and body dissatisfaction was analysed. Results show that there is no relation between body dissatisfaction measured with EDI-BD and BSQ and body size perception.

Discussion

In the present research the use of both staircase and adjustment methods in the evaluation of body size perception and have been analysed.
Results show that in the adjustment method participants estimate the PSE to be closer to zero value (actual size) than in the staircase method. This means that participants produce a more accurate representation of their actual body size when they use the adjustment method. Moreover, it has been observed that males perceived themselves as thinner when they evaluated their side body image than when they evaluated their frontal image, whereas females perceived themselves thinner when they evaluated their frontal image than when they evaluated their side image.
Furthermore, it has been observed how in the staircase method there is a constant descending trend of responses (Figure 2), whereas in the adjustment method responses are constantly around the PSE. This could be due because of those subjects who tend to underestimate have distorted evaluations in the first trials using the staircase method, whereas in the last trials their responses are located around the *plateau*. In fact it is known that the threshold stimulus can be affected by the ranging of the stimuli (i.e. the method of constant stimuli, Vidotto et al., 1996). Finally, the results show no correlation between the perceptual and the cognitive components of body image construct. This means that although these two components belong to the same construct they seem to operate independently (Garner & Garfinkel, 1981).

Acknowledgements
We would like to thank Maria Giulia Panetta and Elisa Moretto for collecting data.

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