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A program for assessing body image disturbance using adjustable partial image distortion

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Body image disturbance has been one of the most widely studied areas in the literature on eating disorders. Some of the tasks designed to assess it have been used to estimate the sizes of specific parts of the body, whereas others have served to make estimations of overall body size. In recent years, the introduction of innovative computing procedures has allowed the two approaches to be combined and has made their application more straightforward. The program we describe here (Body Image Assessment Software, or BIAS) evaluates body image distortions and body dissatisfaction via the on-screen presentation of a scale image, the different components of which can be modified by the patient. The program was developed using Microsoft Access 2000 and Visual Basic for applications. It can be run on any computer with Windows and Microsoft Access 2000 or Microsoft Access 2000 RunTime, which makes it particularly easy to use and enables direct analysis of the recorded data through the use of applications such as SPSS.

We present an innovative interactive computer program developed to assess body image disturbances. Such an assessment is especially indicated in patients with eating disorders, but it may also be of use in other contexts. BIAS (Body Image Assessment Software) is a simple, fast, and economical method for assessing two of the most important body image disturbances—body size distortion and body dissatisfaction—via the modification of a scale image of the subject's figure.

Bruch (1962) was the first researcher to see the dysfunctional experience of body image as a key feature of eating disorders. Since then, although there has not always been a clear consensus on the importance of the concept (Smeets, 1997), numerous studies have focused on subjective body image. Indeed, body image disturbances constitute an essential aspect in the differential diagnosis of eating disorders, distinguishing them from other disorders that also present altered eating habits and changes in body weight (Rosen, 1990). Moreover, body image disturbances play an important role in the development and prognosis of eating disorders (Skrzypek, Wehmeier, & Remschmidt, 2001).

Although there is no universally accepted definition of body image (Hsu & Sobkiewicz, 1991), most researchers take two factors into account: (1) the mental representation of the shape and size of the body—that is, the *perceptual* dimension—and (2) the attitudes, beliefs, expectations, and feelings toward the body—that is, the *cognitive–emotional* dimension. Several authors include both dimensions in their definitions. For Slade (1988), for example, body image is "the picture we have in our minds of the size, shape and form of our bodies; and . . . our feelings concerning these characteristics and our constituent body parts" (p. 20). Williamson, Davis, Bennett, Goreczny, and Gleaves (1989) defined it as "the mental picture and/or attitude that an individual has of the physical appearance of his/her body" (p. 433).

Similarly, most investigations dichotomize body image into a perceptual dimension and a subjective dimension (Sands, 2000). Two aspects of body image dysfunction are distinguished: *perceptual distortion* and *body dissatisfaction* (Cash & Brown, 1987; Cash & Deagle, 1997; Schlundt & Bell, 1993; Thompson, 1990). Perceptual distortion is the inability to accurately perceive one's body size, and body dissatisfaction represents the degree to which people are discontented with the size and shape of their bodies. Perceptual distortion is usually measured with visual tasks, whereas body dissatisfaction tends to be measured through rating scales and questionnaires (Cash, 1991, 1994; P. J. Cooper, Taylor, Cooper, & Fairburn, 1987; Z. Cooper & Fairburn, 1987; Fairburn & Cooper, 1993; Franzoi & Shields, 1984; Garner, Olmstead, & Polivy, 1983; Rosen & Reiter, 1996), although it can also be measured using visual tasks. The difference between real and ideal body size (the size that the subject would like to be) reflects the degree of body dissatisfaction.

Traditionally, the visual tasks used to assess body image fall into two large groups: those that focus on specific body parts, and those that focus on the whole body. Body-part size procedures include techniques such as the movable caliper technique (Gleghorn, Penner, & Schulman, 1987; Reitman & Cleveland, 1964), the visual size estimation procedure (Ruff & Barrios, 1986; Slade & Russell, 1973; Thompson & Spana, 1988), the image-marking technique (Askevold, 1975; Molinari, 1995), and the kinesthetic size estimation apparatus (Gila, Castro, Toro, & Salamero, 1998). Whole-body assessment procedures

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include techniques such as the distorting mirror (Traub & Orbach, 1964), projection of photographs with distorting lenses (Garner, Garfinkel, & Bonato, 1987; Garner, Garfinkel, Stancer, & Moldofsky, 1976; Glucksman & Hirsch, 1969), the video-distortion technique (Allebeck, Hallberg, & Spamark, 1976; Askevold, 1975; Fernández-Aranda, Dahme, & Meermann, 1999; Freeman, Thomas, Solyom, & Hunter, 1984; Meermann & Vandereycken, 1988; Probst, Van Coppenolle, Vandereycken, & Goris, 1992; Smeets, Ingleby, Hoek, & Panhuysen, 1999), the life-size screen distortion method (Gardner & Bokenkamp, 1996; Probst, Van Coppenolle, Vandereycken, Kampman, & Goris, 1991; Probst, Vandereycken, & Van Coppenolle, 1997; Probst, Vandereycken, Van Coppenolle, & Vanderlinden, 1995), and the silhouette method (Bell, Kirkpatrick, & Rinn, 1986; Furnham & Alibhai, 1983).

Both whole-body and body-part procedures have their own methodological drawbacks. In whole-body assessment, subjects modify the shape or size of the entire body—that is, they introduce the same amount of distortion throughout. Therefore, the test does not provide information on distortions of specific body parts. Body-part size estimation procedures, in turn, take into account the differential distortion of body parts but do not offer a holistic vision of the body image. The fact that most of the techniques included in these procedures offer only a frontal view of the body is an additional problem (Schlundt & Bell, 1993).

In recent decades, the development of new technologies has helped to improve many psychological tools (Harper et al., 2003). Many of the methodological failings of traditional body image assessment procedures have been overcome by the use of computers that can combine estimation procedures for the whole body and those for body parts. In most of the applications developed to assess body image disturbance, a human figure appears on the computer screen and subjects can modify each body part separately.

Body Build (Dickson-Parnell, Jones, Braddy, & Parnell, 1987) was one of the first computer applications developed to assess body image distortion. The program provides side and frontal views of a human figure in which the size of each body part can be modified separately. A similar instrument is the Body Image Testing System (BITS) developed by Schlundt and Bell in 1993. BITS displays a human figure in frontal and side views and makes it possible to assess different components of the body image construct. Subjects can modify independently the sizes of nine body parts (face, neck, shoulders, arms, chest, breast, stomach, hips, and thighs) and, at the same time, receive holistic feedback on the whole figure. BITS also administers visual and judgment tasks that permit an assessment of both perceptual and attitudinal components of the body image construct. Despite the advantages of these programs, the body figures that they show are highly unrealistic, so it is usually quite difficult for subjects to identify with the images displayed.

In 1999, Benson, Emery, Cohen-Tovée, and Tovée developed a more realistic technique with computer-generated graphics for the study of body size estimation. The software uses body mass index prototypes created from a database containing 200 photographs of females and 120 photographs of males, to provide realistic simulations of weight gain and loss. The real side and frontal images of the subject are displayed on the computer screen. The subject can manipulate different parts of the body and simultaneously receives holistic feedback on the body image. The main drawback of Benson et al.'s program is that it uses the therapist's subjective estimation to define the prototype that best fits the subject's real figure, with the result that the image presented to the subject is only an approximation of his or her real image.

Recently, Shibata (2002) published a study presenting new software for the assessment of body image estimation. The BodyImage program is based on the image-distorting technique. The program displays the image of the subject's whole figure or of a part of his or her body, previously photographed with a digital camera. The main drawbacks of BodyImage is that it shows only the subject's whole figure or a part of it and does not allow differential distortion of body parts in its holistic feedback on the body.

In recent years, virtual reality has allowed the creation of more realistic programs for body image assessment, in which the silhouettes appear in three dimensions. The BIVRS (Body Image Virtual Reality Scale; Riva, 1997, 1998) is a software program comprising a nonimmersive 3-D graphic interface. Subjects are presented with nine figures of different sizes, ranging from underweight to overweight, and must choose the ones that, in their opinion, best represent their real and ideal body sizes. The discrepancy between the two measures is an indicator of the degree of the subject's body dissatisfaction. The BIVRS is designed for use on a local computer and on the Internet in VRML format.

Virtual Body (Alcañiz et al., 2000; Perpiña et al., 1999) is an immersive graphic interface for the evaluation and treatment of body image disturbances in subjects with eating disorders. The program presents a 3-D figure on the computer screen. The subject can modify the size of the parts into which the body is divided. For the purposes of treatment, the program also generates a transparent female figure that reproduces the subject's real measurements, which can be superimposed on the generated image so that the subject can see the discrepancy (if any) between the generated image and the real one.

The applications designed by Riva (1997, 1998) and by Perpiña and coworkers (Alcañiz et al., 2000; Perpiña et al., 1999) both present subjects with a realistic female image with which they can identify. However, both have limitations. Riva's instrument does not allow modification of individual parts. The subject's real body image is generated by the therapist, who adjusts each of the parts from photographs of the patient taken from different angles. This means that the size of the image may be biased by the perception and skill of the therapist.

The program we describe here displays side and frontal views of a scale female human figure that is the same size

as the subject. The image can be adjusted by independent modification of six body parts (head, arms, breast, waist, hip, and legs) in the frontal view and five body parts (head, breast, waist, hip, and legs) in the side view, with the computer mouse. The subject's real body image is generated by entering the body's objective measurements into a database. The program offers two visual tasks, which can be administered together or independently. In the first, subjects are asked to modify several frontal and side views of body parts in order to make a human figure correspond as closely as possible to their real body image. In the second task, subjects modify frontal and side views of body parts to make a human figure representing their ideal body image. The discrepancy between a subject's real and perceived body sizes provides information about his or her degree of perceptual distortion. The discrepancy between perceived body size and ideal body size provides information about his or her degree of body image dissatisfaction.

The main goals of BIAS are as follows:

1. to display a scale image of a human female figure. The therapist measures the real length and breadth of each part of the subject's figure and enters them into the computer. With these data, the program generates a female figure that reflects the subject's real image;
2. to allow the differential distortion of several body parts in the context of the whole body;
3. to detect the presence of differences between frontal and side views in the amount of distortion of or dissatisfaction with the body parts;
4. to assess both of the principal components of body image distortion (i.e., perceptual distortion and body dissatisfaction);
5. to be accessible on any computer;
6. to analyze the compiled data directly using widely available applications, such as SPSS and Excel; and
7. to provide an economical, rapid, and easy method for assessing body image distortion.

BIAS allows the use of objective measures of the patient to generate a scale model. In contrast, in most of the programs mentioned above it is the therapist who chooses the figure that most closely resembles the patient's silhouette. Obviously, this choice is subjective. Shibata's (2002) program, like ours, also shows a scale image of the real size of the subject, but its great disadvantage is that it does not allow separate adjustments of each body part, which our software is able to do. BIAS also allows independent modification of the frontal and side perspectives of the parts of the figure that appear on the screen. This means that it is possible to detect the presence of differences in the degree of distortion or the degree of dissatisfaction felt toward each body part.

Finally, the program can be installed straightforwardly on any computer with Windows and Microsoft Access 2000 or Microsoft Access 2000 RunTime, and the data compiled can be analyzed directly in widely used applications such as SPSS and Excel. We stress that this is not a characteristic that is exclusive to BIAS. Many programs created for body image evaluation (e.g., Schlundt & Bell, 1993; Shibata, 2002) are easily accessible, but they have the limitations that we have mentioned above.

Program Specifications

The program was developed with Microsoft Access 2000, which was chosen because it is easy to use on most computers. The use of this program makes it possible for nonexpert users to transfer and treat the data in other applications, such as SPSS and Excel. The programming for modification of the images was developed with Visual Basic for applications. To run the program, an operating system equal or superior to Windows 98, and Microsoft Access 2000 or Microsoft Access 2000 RunTime (freeware), is required.

Algorithms: From the Real Image to the Computer-Simulated Image

The program presents a scale image of the patient's body on the computer screen. A series of measurements corresponding to the real length and width of each of the parts into which the subject's figure is divided are recorded beforehand and entered into the database (Figure 1).

As its unit of reference, the program uses the *twip* (the unit of measurement used by Microsoft Access; 567 twips = 1 cm). This unit permits calculation using real measurements to obtain a scale image.

The image shown on the screen can be modeled to scale, thanks to its segmentation into a total of 111 fragments for the frontal image and 138 fragments for the side image. These fragments are horizontal rectangles that the program modifies automatically by means of a programming module that scales the image. In order to model the breast, for instance, the program takes as references the measurements (in twips) of the head, breast, and waist. The formula used to model the fragments is

$$T_n = T_{n-1} - \left[\left(R_s - R_i\right) / N\right],$$

where T_n is the size of fragment n, T_{n-1} is the size of the previous fragment, R_s is the superior reference, R_i is the inferior reference, and N is the total number of fragments between the superior and inferior references.

To ensure that the image is not polygonal (and thus unrealistic), a module smooths the reference measurements and gives the image a more natural appearance.

The patient may vary the image on the screen according to the objective of the test (e.g., evaluation of either the perceived image or the desired image) in both frontal and side views. Each part of the body image can be modified separately and made either larger or smaller. Once the patient has modified the image, the program compares the real-scale measurements entered in the database with the modifications made by the patient, thus obtaining the percentage of distortion of each of them and the percentage of overall distortion (i.e., the mean of the partial distortions).

The screen presented in Figure 2 shows the controls that the patient uses to modify the image.

The results are stored in a table in Microsoft Access 2000. This facilitates transfer of data from other applications, such as SPSS, Excel, or Word.

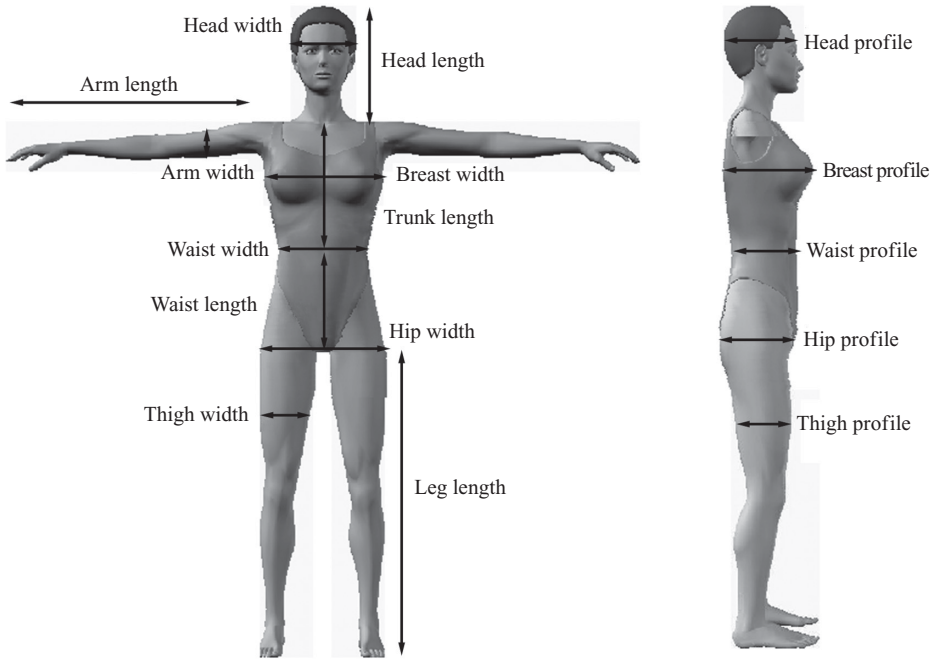

Figure 1. Measurements needed to construct the patient's scale image.

Conclusions

Many instruments have been developed to assess body image disturbances, especially in patients with eating disorders. These instruments have traditionally been classified in two large groups: methods for estimating subjects' images of body parts and methods for estimating their images of the whole body. Body part estimation methods have been criticized for not providing a holistic vision of the body image of the subject, meaning that the estimation of the size of the different body parts has no context. Whole body estimation methods, in turn, are criticized for not allowing independent modification of different

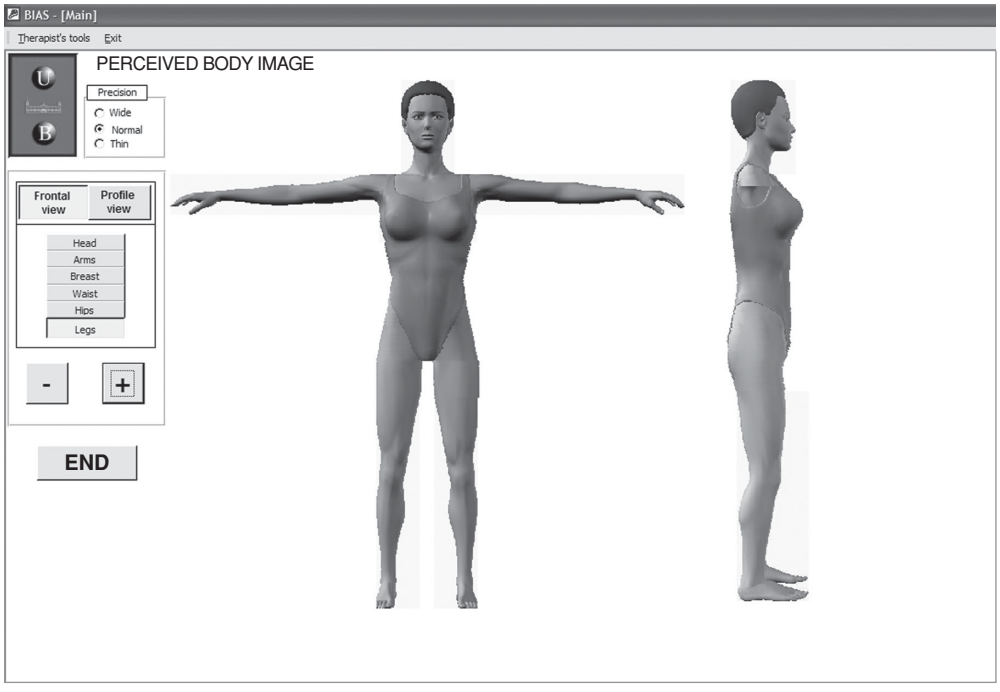

Figure 2. Controls for modifying the image.

parts of the body, meaning that it is impossible to detect distortion of or dissatisfaction with one specific body part.

New technologies—especially computer programs—have allowed the development of new instruments for assessing body image which, in many cases, have found answers to the criticisms made of the traditional methods. Most of these instruments allow distortion of the different body parts and offer an overall vision of body image. Examples are Body Build (Dickson-Parnell et al., 1987), BITS (Schlundt & Bell, 1993), the application proposed by Benson et al. (1999), BodyImage (Shibata, 2002), and Virtual Body (Alcañiz et al., 2000; Perpiña et al., 1999). All of these are of great interest, but they have disadvantages, such as the lack of realistic figures, the fact that subjects may find it difficult to identify with the images presented, subjectivity in the generation of the figure representing the real image of the subject, and the difficulties involved in treating the data generated.

BIAS is economical, rapid, and easy to apply. It permits the evaluation of body size distortion and body dissatisfaction by modifying a scale figure of the subject, it allows independent distortion of different parts of the body, and it provides holistic feedback on the body image. Further advantages are that it can be run on any computer that has Windows and Microsoft Access 2000 or Microsoft Access 2000 RunTime, and that the data can be analyzed directly using applications such as SPSS and Excel. Thus, its strong points are its accessibility and its ability to generate a female figure to scale that realistically represents the silhouette of the subject.

Availability

The program can be downloaded from http://www.ub.es/personal/ecic.zip and saved on a computer. The only condition is that the user must mention the authors each time he or she uses or refers to the program.

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