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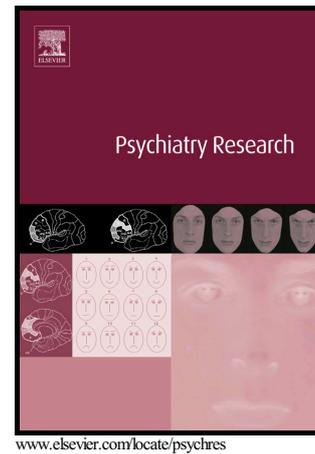
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Intrapersonal, interpersonal, and physical space in anorexia nervosa: a virtual reality and

repertory grid investigation

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Abstract

Anorexia nervosa (AN) is an eating disorder characterized by severe body image disturbances. Recent studies from spatial cognition showed a connection between the experience of body and of space. The objectives of this study were to explore the meanings that characterize AN experience and to deepen the examination of spatiality in relational terms, through the study of how the patient construes herself and her interpersonal world. More specifically this study aimed (1) to verify whether spatial variables and aspects of construing differentiate patients with AN and healthy controls (HCs) and are related to severity of anorexic symptomatology; (2) to explore correlations between impairments in spatial abilities and interpersonal construing. A sample of 12 AN patients and 12 HCs participated in the study. The Eating Disorder Inventory, a virtual reality-based procedure, traditional measures of spatial abilities, and repertory grids were administered. The AN group compared to HCs showed significant impairments in spatial abilities, more unidimensional construing, and more extreme construing of the present self and of the self as seen by others. All these dimensions correlated with the severity of symptomatology. Extreme ways of construing characterized individuals with AN and might represent the interpersonal aspect of impairment in spatial reference frames.

Keywords: Body Image; Eating Disorders; Experience; Personal Construct; Spatial Cognition; Virtual Environment

1. Introduction

Body image disturbance has been considered one of the most important symptoms in anorexia nervosa (AN) although its causes are still unclear (American Psychiatric

Association, 2013; Dakanalis and Riva, 2013; Gardner and Brown, 2014; Lin and Soby, 2016; Phillipou et al., 2016). Slade and Russell (1973) found that patients with Eating Disorders (ED) overestimated their body size when compared with healthy controls, and interpreted this as a perceptual phenomenon. However, Smeets et al. (2001) found that there is no difference in perceptual sensitivity between AN patients and normal and thin control groups (Garfinkel et al., 1978; Smeets, 1997). Similarly, Smeets and Kosslyn (2001) demonstrated that AN patients' body image disturbance results from body size distortions in memory rather than perception.

A recent neurocognitive account, namely Allocentric Lock Theory (ALT), suggests a possible role of the way the body is "experienced" and "remembered" in relation to spatial processing that may contribute to body-image distortions in EDs (Dakanalis et al., 2016; Riva, 2014; Riva et al., 2014). A growing body of research from cognitive neuroscience indicates that our spatial experience, including that related to our body, is organized around two different reference frames (Byrne et al., 2007; Dakanalis et al., 2016): egocentric and allocentric. The egocentric frame is based on the body of the perceiver and has its principal source in "somatoperceptions", i.e., representations of the current state of the body from perceptual input (Riva et al., 2014; Serino et al., 2016). Conversely, within the allocentric frame, the body is an object similar to others in the physical world, with its representation (Longo et al., 2010) based on abstract knowledge, beliefs, and attitudes (Riva, 2014). According to Byrne's (2007) model of spatial memory, these frames play a critical role in the way memories are stored and retrieved: the short-term memory of perceptual information is shaped by egocentric parietal representations and long term memory is modeled by medial temporal allocentric representations. Following these premises, Allocentric Lock Theory (Dakanalis et al., 2016; Riva, 2014; Riva et al., 2014) assumes that impairments in the translation between the egocentric and allocentric reference frames, for exogenous (e.g.,

stress) or endogenous (e.g., brain abnormalities in the areas involved in spatial processing) reasons, could trap ED patients in a negative (e.g., my body is fat) long term memory of their body stored as an enduring allocentric representation. EDs may therefore be associated with an impairment in the ability to update the stored allocentric representation of the body with egocentric perception driven inputs.

There is some empirical support for this theory (Dakanalis et al., 2016; Malighetti et al., 2016; Serino et al., 2015). Serino and co-workers (2015) showed that both anorexic and bulimic patients, compared to matched healthy participants, displayed not only significantly poorer visuo-spatial, mental rotation, and short and long-term spatial mnestic abilities, but also they were significantly less accurate in retrieving the position of the memorized object in two virtual-based tasks, requiring the ability to store and retrieve an allocentric representation, and then to refer to this stored long-term representation and update it according to perceptual inputs.

However, it remains unclear how egocentric and allocentric spatial processing are related to the individual's perception of the self and others, and this will be the focus of the current study, which will adopt a multidimensional approach and draw upon personal construct theory (PCT) (Kelly, 1955). From this theoretical perspective, EDs are viewed as "strategies" for dealing with the developmental issues characterizing interpersonal relationships and the formation of identity (Button, 1993; Erikson et al., 2012). Kelly (1955) considered individuals as scientists involved in the anticipation of their worlds through the formulation and testing out of hypotheses, or constructions of events, and revision of these if they are invalidated (Winter and Button, 2010). PCT views psychological disorders as involving a lack of this revision process despite repeated invalidation (Kelly, 1955). In their constructivist model of AN, Button and Warren (2002) assumed that anorexic people try to avoid anxiety derived from repeated invalidating experiences in the relational field by

focusing on issues such as eating and weight, with the aim of making their life more manageable. The eating and weight domains may offer ways of construing (i.e. placing an interpretation, Kelly 1955 p.50) which enable the person to predict and control the world (Faccio et al., 2016; Salvini et al., 2012).

The central idea derived from PCT empirical investigations is that AN is associated with deficits in interpersonal construing characterized by relatively rigid and impoverished construing of the self and others (Winter and Button, 2010). Button (1993) suggested that in an attempt to avoid anxiety deriving from unpredictable situations, anorexic people's construing of the world is characterized mainly by constriction, a strategy that may serve to reduce uncertainty deriving from an "apparent incompatibility" in construing by restricting the world to events that are predictable. Furthermore, there is evidence of unarticulated, extreme, and 'cognitively simple' (unidimensional and undifferentiated) structures in anorexics' construing, and negative self-construing, compared to people presenting with bulimia and normal control groups (Button, 1993; Mottram, 1985; Neimeyer and Khouzam, 1985; Winter and Button, 2010). An extreme construction of self and others might make a person more vulnerable to psychopathology (Cipolletta, 2011; Fransella et al., 2004).

On the basis of these premises, the current study explored how anorexic patients' deficits in spatial abilities and spatial reference frame processing related to aspects of construing that have been associated with AN (namely unidimensional and extreme construing), particularly in relation to constructions of the self and others. Specifically, we hypothesized that:

– compared to controls, anorexic patients will display unidimensional and extreme construing, and negative self-construing;

– compared to normal controls, anorexic patients will display impairments in short and

long-term spatial memory, navigation, mental rotation and visuo-spatial abilities especially in the capacity for representing and recalling representations of spatial information through the interaction between the allocentric and egocentric reference frame;

− the above aspects of construing characterizing anorexics will be positively interrelated with impairments in spatial cognition, and also correlated with measures of severity of anorexic symptomatology.

2. Materials and Methods

2.1 Participants

Twenty-four young women participated in the study (mean age = 23.04; SD= 6.10): 12 participants with AN (mean BMI = 16.87 Kg/ m^2 (SD=1.40)), recruited from a clinical centre in Northern Italy; and 12 healthy control participants (HCs) matched for age, race/ethnicity, language and education (mean BMI = 19.88 Kg/ m^2 (SD=1.51)). AN diagnoses according to the clinical criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV-TR) (American Psychiatric Association, 2013) were assigned based on clinical interviews completed by experienced staff.

Exclusion criteria included visual impairments and vestibular disorders. The Ethics Committee of the Catholic University (Milan) approved the study.

2.2 Measures

2.2.1 Clinical assessment

The Eating Disorder Inventory (EDI 3) (Garner, 2004) was administered to evaluate the severity of symptomatology. This measure consists of 91 items organized into 12 primary scales (Drive for Thinness, Bulimia, Body Dissatisfaction, Low Self-Esteem, Personal

Alienation, Interpersonal Insecurity, Interpersonal Alienation, Interoceptive Deficits, Emotional Dysregulation, Perfectionism, Asceticism, and Maturity Fears) that provide a standardized clinical evaluation of symptomatology associated with eating disorders. Items are scored using a six choice format (from always to never). The administration required 20 minutes.

2.2.2 Spatial Assessment

In order to evaluate spatial abilities, the following tests were administered:

- Corsi Block Test-Span and Supraspan (Corsi, 1972) to assess short and long-term spatial memory respectively. The test consisted of nine wooden blocks positioned on a wooden board, placed between the experimenter and the participant. In the Corsi Span, the participant had to reproduce a given sequence by tapping the wooden blocks in the same order as the researcher, with increasing sequence length on each trial. In the Corsi Supraspan, the participant had to repeat several times (max. 8) a given sequence of nine blocks. The procedure ended when the number of wrong reproductions exceeded the proportion of admissible errors per length.

- Money Road Map (Money et al., 1965) to assess navigation abilities. This is a paper and pencil assessment of left right discrimination that concerns egocentric mental rotation ability in space. The test consisted of a city map on which was drawn a pathway with a 32 step dotted route. The participants had to imagine themselves traveling along this route to decide whether a right or left turn was demanded at each intersection. No time limit was imposed and the maximum score was 32 points (cut off of 10 errors).

- Manikin's Test (Ratcliff, 1979) to assess mental rotation abilities. The test consisted of 32 sheets presenting a man from different perspectives who holds a ball. The

participants had to evaluate in which hand the man was holding the ball. There was no time limit and the maximum score was 32 points.

- Judgment of Line Orientation (Benton et al., 1978) to assess visuo-spatial abilities. The test consisted of 30 sheets showing two lines positioned above a reference figure containing 11 lines arranged in a semicircle and numbered from 1 to 11. The participants had to identify their angular positions in relation to the reference figure. No time limit was imposed and the maximum score was 30 points.

After the administration of the above measures, a well validated (Malighetti et al., 2016; Serino et al., 2015) virtual reality (VR)-based procedure (consisting of an encoding phase, followed by a retrieval phase in two different counterbalanced tasks) was used to investigate egocentric-allocentric spatial reference frame processing.

2.2.3 Repertory grid

The repertory grid (Kelly, 1955) was used for studying personal and interpersonal systems of meaning that might otherwise be inaccessible to AN participants on direct request (Vitousek et al., 1991). The repertory grid consists of elements and constructs. Elements are aspects of the world, usually people, that are construed. In the present study, they were selected based on previous research on eating disorders (Button, 1993; Button and Warren, 2002) and were: present self, future self, self before AN (self in the past in HC group), ideal self, self at your ideal weight, self as others see you, self at the weight most people wish for you, present body, a person you like, a person you dislike, mother, father, and best friend. Constructs are the bipolar descriptors that the person uses to give sense to the elements. Thirteen constructs were elicited through the triadic method. The elements were presented in sets of three to the participant, who was asked for each triad to think of a way in which two of the elements were alike and thereby different from the third (Fransella et al., 2004). The

participant was then asked to rate the elements on each construct on a 1-7 point scale. The grid consists of a matrix of numbers in which the columns represented the elements and the rows the constructs.

2.3 Procedure

The administration of tests of spatial abilities was followed by VR-based tasks. At the end of the VR procedure, the repertory grid was administered. The virtual environments were rendered using a portable computer. The participants also had a gamepad (Logitech 940-000114 F510), which allowed them to explore and interact in first person with the virtual environment of a city built around a central square with a tower in the middle (Figure 1), which represents the starting point of the navigation. The virtual city was developed using the software NeuroVirtual 3D (Cipresso et al., 2016; Cipresso et al., 2014), a recent extension of NeuroVR (Riva et al., 2011). This software, commonly used in eating disorder research (Pla-Sanjuanelo et al., 2015; Serino et al., 2015), provides researchers a free VR-platform for customizing a large number of virtual environments already developed, which are useful for the assessment of different cognitive abilities.

After an initial training in VR technology, the experimental procedure started with an encoding phase in which participants were asked to find a hidden object and memorize its position in the virtual city. After they had discovered the object, they were invited to indicate its position on a real map (a full aerial view of the virtual city) with a pen (Task 1). In Task 2, participants were invited to retrieve the position of the object, which was absent, after entering the virtual city from another starting point. Task 1 ("allocentric retrieval") required the ability to retrieve an allocentric representation, while Task 2 ("spatial synchronization") assessed the ability to refer to this stored long-term representation and update it according to (egocentric) perceptual-driven inputs. In both tasks, the spatial accuracy (i.e., difference

between the correct and the estimated positions) of the answer was the dependent variable. There was no time limit. The entire testing procedure, the timeline for which is indicated in Figure 2, required about two hours.

2.4 Data analysis

  2.4.1 Spatial Assessment

  "Allocentric Retrieval" and "Spatial Synchronization" were assessed by measuring the accuracy of spatial location, which was defined as the difference between the correct and the estimated positions of the object (Serino et al., 2015; Serino and Riva, 2015). First, spatial coordinates (x and y) of the object location in the two VR-based tasks (i.e. Task 1 and Task 2) were corrected by dividing the measured distance by the total length: in this way all the coordinates had a value between (0,0) and (1,1), where (0,0) was at the bottom left side of the city, (1,1) was at the top right side of the city, and (0.5,0.5) was at the center of the city. This operation was needed to compare the two different tasks. Once corrected, the spatial coordinates could be compared by calculating their distance using the formula $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$, where (x_1, y_1) and (x_2, y_2) are the corrected coordinates. Thus, the several distances calculated within this procedure were always corrected coordinates and were comparable with each other. Since these two variables were not normally distributed, a logarithmic transformation was carried out. Differences between the AN and HC groups on spatial measures were examined with Mann Whitney U tests because these measures were not normally distributed.

  2.4.2 Repertory Grids

  Repertory grids were analyzed with the Idiogrid software programme, allowing a range of measures (Cipolletta, 2011; Neimeyer and Khouzam, 1985) to be calculated. Some involved Euclidean distances between elements (ranging from 0 to 2, with a higher distance indicating

greater construed dissimilarity between the elements concerned), namely:

- Change (Euclidean distance between present self and self before anorexia);

- Self Esteem (Euclidean distance between present self and ideal self, the lower the distance the higher the self esteem);

- Social Desirability (average Euclidean distance between present self and a person I like, the lower the score the higher the social desirability).

Other grid measures were the following:

- The number of midpoint ratings, which might indicate constriction of construing (Stojnov and Procter, 2010), applied to the present self, present body, and self as others see me;

- Extremity of construing (assessed by counting the number of extreme ratings in the grid) in relation to the present self, the present body, and self as others see me;

- Variance accounted for by the first component from principal component analysis of the grid (a high variance indicating unidimensional construing).

Differences between the AN and HC groups on repertory grid measures were investigated with two-sample t-tests.

2.4.3 Correlations

Pearson correlations were conducted between measures of spatial abilities, measures of egocentric-allocentric spatial reference frame processing, repertory grid indices, and EDI 3 scores (Garner, 2004).

3. Results

3.1 Group differences on spatial measures

Results indicated that AN patients encountered significantly greater difficulties in navigation [U=37; z=-2.048; p=0.041] and mental rotation abilities [U=42,5; z= -2.036; p=0.042] than HCs. No significant difference emerged between the two groups as concerns short [U= 148; z= -0.118; p= 0.906] and long-term spatial memory abilities [U=55; z=-0.981; p=0.326] and visuo-spatial abilities [U=54; z= -1.051; p= 0.293]. Figure 3 offers an overview of spatial neuropsychological assessment divided between the two groups.

3.2 Group differences on repertory grid measures

As indicated in Table 1, the AN group compared to HCs showed a significantly higher level of variance accounted for by the first principal component of the grid, a greater distance between construing of the past and present self, and more extreme construing of the present self, present body, and self as others see them. AN patients applied less midpoint ratings generally and to the present self and body.

3.3 Correlations between spatial and repertory grid scores

The correlations between spatial assessment and repertory grid scores (Table 2) showed that good performance on the Money Road Map Test was significantly associated with less extreme construing, and more midpoint ratings, of the self as seen by others. Good performance on the Manikin test was associated with less extreme construing of the present self, present body, and self as seen by others, and more midpoint ratings of the present body and self as seen by others. Good performance on the Judgement of Line Orientation Test was associated with a less extreme view, and more midpoint ratings, of the present body, and a lower level of perceived change in the self from the past to the present. Good performance on

the Corsi Block Test was associated with less extreme construing of the present self, present body, and self as seen by others. High accuracy of spatial synchronization (as indicated by low scores on this measure) was associated with less extreme construing of the self as seen by others. Figure 4 illustrates some of these correlations.

3.4 Correlations between spatial and questionnaire score

As indicated in Table 3, good performance on the Money Road Map Test, Manikin's Test, Judgment of Line Orientation Test, and Spatial Synchronization (in the latter case indicated by low scores) was associated with a range of measures of lower levels of eating disorder severity and of maladjustment. Good performance on Allocentric Retrieval (again indicated by low scores) was associated with low levels of bulimia.

3.5 Correlations between repertory grid and questionnaire scores

As indicated in Table 4, extreme construing of, and less midpoints applied to, the present self, present body, and self as seen by others were associated with higher scores on a range of measures of severity of eating disorder and maladjustment (although extreme construing of the present self was also associated with a low level of personal alienation). Extreme construing was also associated with emotional dysregulation. Dissimilarity in construing of the self and ideal self was associated with high scores on measures of maladjustment. High perceived change from the past to the present was associated with a high drive for thinness. Undifferentiated construing, as reflected in a high percentage of variance accounted for by the first principal component of the grid, was associated with a high level of fear about maturity.

4. Discussion

A principal focus of the study was to explore the personal meanings of anorexic patients,

specifically in relation to their constructions of personal and interpersonal experience. Results from the repertory grid, consistent with previous research (Button, 1990; Button and Warren, 2002; Winter and Button, 2010), showed that AN patients compared to HCs had more unidimensional and extreme construing, specifically in relation to the present self and self as seen by others.

As indicated above, people with AN have also been regarded as characterized by constriction of their worlds to the sphere of eating (Winter and Button, 2010). Although our grid measures of constriction, based on the use of midpoint ratings, indicated this to be lower in the anorexic group than in the healthy controls, this was probably an artifact of the more extreme construing of the anorexic participants, and of the possibility that the measures used may not be indicative of constriction. An alternative way to measure constriction has been provided by Ross (1985), who defines constriction as the excessive use of certain rating scale points, regardless of what point these are, which is very consistent with the use of extreme ratings in the present study.

Finally, the AN group showed a higher level of perceived change in the self compared to the healthy group. This perception of changing does not necessarily involve the possibility of change in the future, but it could be considered as perception of development of the anorexic's plans, and the awareness of life choices focused on eating and weight, which give meaning to experiences, making them more predictable and controllable.

The features that characterized the construing of individuals with AN also tended to be associated with high scores on measures of eating disorder and maladjustment. Consistently with previous research (Button and Warren, 2002), this was particularly so with measures of extreme and negative self-construing (Button et al., 1997). The high correlation between perceived change and drive for thinness may be a further indication of the anorexic's need to

plan a change involving taking control of their life. Finally, the association between unidimensional construing and fear of maturity is in line with the literature (Button, 1993; Mottram, 1985; Winter and Button, 2010) and seems to indicate a link between fear of change and control. Adopting unidimensional construing might be a way to keep control of events and avoid invalidation.

A further aim of the study was to explore how impairments in spatial abilities and spatial reference frame processing characterizing AN patients may be related to aspects of construing, particularly regarding the self and others. Extreme construing of the body and of the self as seen by oneself and others, and high perceived change in the self were associated with deficits in spatial abilities. In line with previous studies (Malighetti et al., 2016; Serino et al., 2015) our results showed impairments in spatial navigation and mental rotation abilities in the anorexic group compared to the healthy one. These results were supported by correlations between scores from the measures of spatial abilities and those from measures of eating disorders, not least the fact that every scale associated with eating disorder, and in particular its psychological aspects, was associated with poor performance in navigation abilities, mental rotation abilities, visuo-spatial abilities and in spatial synchronization. Moreover, these findings are consistent with ALT in suggesting that people with AN may be characterized by an impairment in the spatial reference frame that might be connected to distorted body representations (Dakanalis et al., 2016; Riva, 2014; Riva et al., 2014).

From a constructivist perspective, these spatial deficits may relate to an unvarying and rigid way of construing self and others, which has been developed in order to avoid invalidations and anxiety derived from social interactions involving body image (Wong and Qian, 2016). The extreme view of the self, associated with the impairment in the processing of reference frames, does not allow the person to have a full and elaborate representation of

space and the body. AN patients are therefore trapped in a "self focused" construction of the world reinforced by the use of a static and unmalleable reference frame.

A limitation of the study, which should be addressed in further research, is the small sample size. Further research could also usefully examine changes on the spatial and the repertory grid measures over the course of therapy with AN patients.

5. Conclusions

This study has demonstrated impairments in spatial cognition and unidimensional, extreme and rigid ways of construing self and others in AN. It is proposed that these could represent a unique impairment in the construction of identity, expressed in different ways, that constitutes the core symptom of AN.

The original combination in this study of very different types of measures has facilitated a multidimensional perspective on anorexia. It also provides further evidence for the validity of the measures concerned: for example, it is one of relatively few studies that have related repertory grid measures to measures of behavior (Fransella et al., 2004). VR, by providing exposure to virtual environments, might usefully be integrated with a therapeutic approach based on PCT. This technology represents an experiential tool able to allow safe exploration of changes in the experience of the body (Riva, 2014), which may improve the processing of spatial reference frames in AN, and facilitate reconstruing of the self and its relationship with others.

Conflict of interests

The authors declare no conflicts of interest with respect to the authorship and/or publication of this article.

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FIG 1. A picture of the VR

FIG 2. Timeline of Procedure
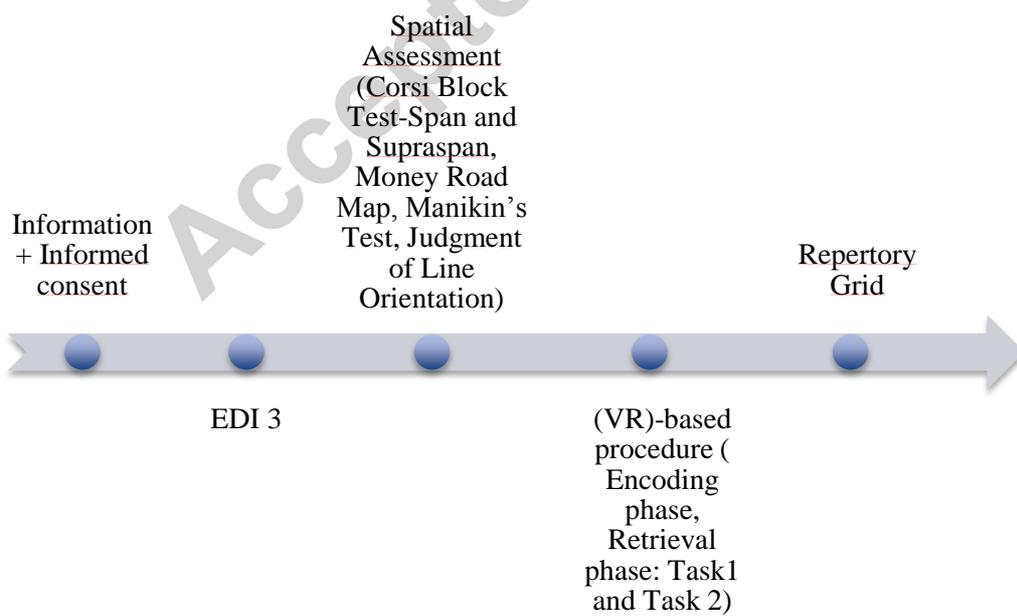
FIG 3. Differences between anorexic patients and healthy controls on measures of spatial abilities
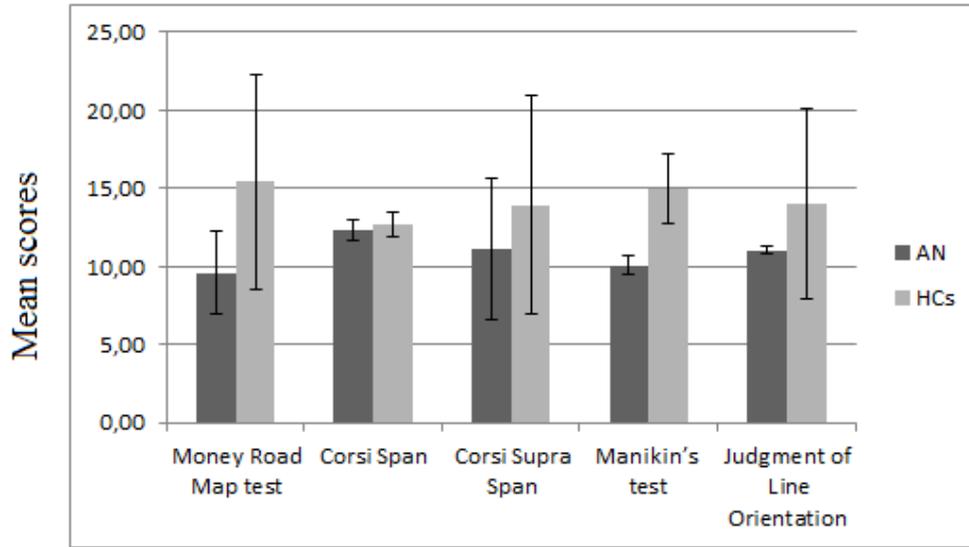

FIG 4. Dispersion diagrams of some of the significant correlations between scores on spatial and repertory grid measures.
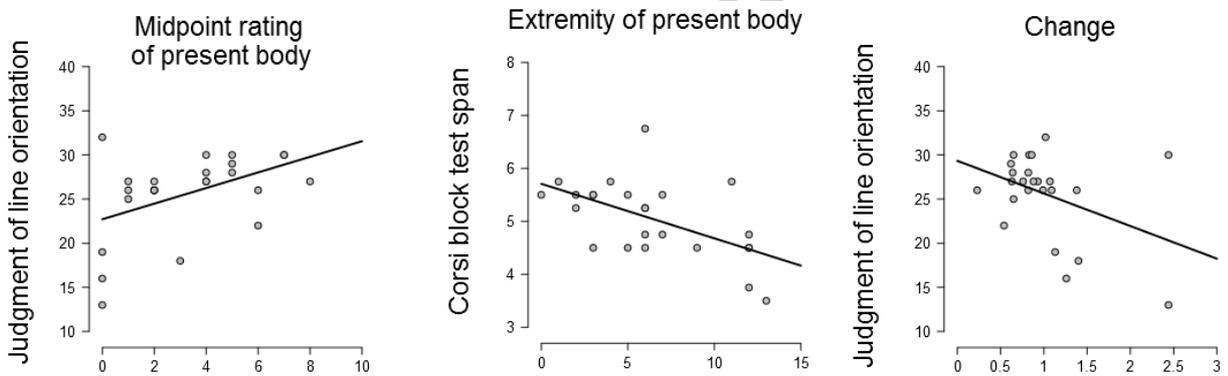

TABLE 1. Differences between anorexic patients and healthy controls on repertory grid measures.

Indices	AN	HCs		
	Mean	Mean	t	p

Midpoint Ratings	23.58	32.92	-2.193	0.039*
Midpoint Ratings of present self	1.42	3.50	-2.553	0.018*
Midpoint Ratings of self as other see me	2.25	4.00	-1.619	0.120
Midpoint Ratings of present body	2.17	4.42	-2.458	0.022*
Variance accounted for by the first component	64.54	42.65	4.742	0.000**
Self Esteem	1.02	0.99	188	0.853
Social Desirability	1.01	0.95	0.405	0.689
Change	1.28	0.58	3.057	0.006**
Extremity of construing	104.25	104.25	2.945	0.007**
Extremity of present self	9.00	5.50	3.386	0.003**
Extremity of present body	8.08	4.17	2.716	0.013*
Extremity of self as other see me	7.25	3.67	2.964	0.007**

Notes. AN, anorexia nervosa; HCs, Healthy control. p exact Sig. [2*(1-tailed Sig.)]*p<. 05.**p<.01.***p<.001.

TABLE 2. Correlations between scores on spatial and repertory grid measures

Indices	Corsi Block Test- Span	Corsi Block Test- Supraspan	Money Road Map	Manikin's Test	Judgment of Line Orientation	Spatial Synchronization	Allocentric Retrieval
Midpoint Ratings	0.393	0.226	0.169	0.288	0.399	-0.214	0.023

Midpoint Ratings of Present Self	0.399	-0.97	0.272	0.392	0.383	-0.227	0.032
Midpoint Ratings of Self as other see me	0.212	0.058	0.449*	0.473*	0.211	0.225	-0.215
Midpoint Ratings of Present Body	0.321	0.058	0.357	0.544**	0.461*	-0.165	-0.098
Variance accounted for by the first component	-0.337	-0.181	-0.045	-0.098	-0.087	0.221	0.022
Self Esteem	-0.308	-0.072	-0.217	-0.120	0.137	-0.013	0.062
Social Desiderability	-0.238	-0.174	-0.230	-0.287	-0.084	-0.081	0.323
Change	-0.076	-0.314	-0.118	-0.262	-0.405*	0.186	0.135
Extremity of construing	-0.343	-0.300	-0.141	-0.185	-0.311	0.291	0.166
Extremity of Present Self	-0.413*	-0.228	-0.263	-0.551**	-0.293	0.195	0.001
Extremity of Present Body	-0.561**	-0.267	-0.249	-0.453*	-0.463*	0.183	0.095
Extremity of Self as other see me	-0.223	-0.448*	-0.427 *	-0.458*	-0.400	0.432*	0.380

Note. * Pearson Correlation; p Asymp. Sig. (2-tailed) *p<.05.**; p<.01.:***p<.001.

TABLE 3. Correlations between spatial assessment and questionnaire scores

Indices	Corsi Block Test- Span	Corsi Block Test- Supraspan	Money Road Map	Manikin's Test	Judgment of Line Orientation	Spatial Synchronization	Allocentric Retrieval
DT	-0.071	0.024	-0.351	-0.577**	-0.156	-0.094	0.089
B	0.258	-0.144	0.060	0.100	0.039	0.144	0.424*
BD	-0.035	0.091	-0.226	-0.454*	-0.026	-0.201	0.067
EDRC	0.039	0.067	-0.267	-0.417*	-0.071	-0.132	0.086
LSE	-0.225	-0.320	-0.543**	-0.465*	-0.325	0.146	0.225
PA	-0.353	-0.300	-0.635**	-0.366	-0.437*	0.193	0.137
II	0.078	0.207	-0.194	-0.465*	0.086	-0.100	-0.141
IA	0.244	-0.244	-0.682**	-0.579**	-0.332	0.245	0.131
ID	-0.049	-0.254	-0.485*	-0.597**	-0.286	0.419*	0.167

ED	-0.032	-0.352	-0.671**	-0.539**	-0.434*	0.614*	0.313
P	0.126	-0.336	-0.141	-0.365	-0.144	0.457*	0.175
A	0.175	0.032	-0.351	-0.589**	-0.082	0.249	0.093
MF	-0.191	-0.176	-0.422*	-0.229	-0.198	0.260	0.048
IC	-0.299	-0.342	-0.595**	-0.438*	-0.415*	0.168	0.207
IPC	-0.062	0.020	-0.439*	-0.565**	-0.098	0.049	-0.030
APC	-0.043	-0.308	-0.571**	-0.606*	-0.355	0.512*	0.235
OC	0.179	-0.188	-0.262	-0.548**	-0.129	0.404	0.164
GPMC	-0.121	-0.244	-0.574**	-0.574**	-0.300	0.325	0.176

Note. DT Drive for Thinness; B Bulimia; BD Body Dissatisfaction; EDRC eating Disorder Risk Composite; LSE Low Self-Esteem; PA Personal Alienation; II Interpersonal Insecurity; IA Interpersonal Alienation; Id Interoceptive Deficits; ED Emotional Dysregulation; P Perfectionism; A Ascetism; MF Maturity Fears; IC Ineffectiveness Composite; IPC Interpersonal Problems Composite; OC Overcontrol Composite; GPMC Global Psychological Maladjustment Composite. * Pearson Correlation; p Asymp. Sig. (2-tailed) *p<.05.**p<.01.***p<.001

TABLE 4. Correlations between repertory grid and questionnaire scores.

INDICES	DT	LSE	PA	II	IA	ID	ED	MF	IC	IPC	APC	GPMC
Midpoint Ratings of Present Self	-0.305	-0.404	-0.324	-0.141	-0.348	-0.349	-0.223	-0.407*	-0.380	-0.251	-0.324	-0.339
Midpoint Ratings of Self as other see me	-0.305	-0.238	-0.221	-0.095	0.412*	-0.277	-0.301	0.080	-0.243	-0.251	-0.294	-0.208
Midpoint Ratings of Present Body	-0.403	-0.391	-0.429*	-0.377	-0.51*	-0.349	-0.339	-0.170	-0.432*	-0.479*	-0.363	-0.404
Variance accounted for by the first component	0.449	0.286	0.315	0.285	0.360	0. 378	0.131	0.492**	0.303	0.349	0.315	0.388
Self Esteem	0.044	0.598**	0.581**	0.328	0.422*	0.377	0.319	0.281	0.584**	0.405*	0.381	0.503*
Social Desiderability	-0.088	0.592**	0.551**	0.346	0.296	0.260	0.211	0.143	0.590**	0.405*	0.261	0.415*
Change	0.462	0.195	0.227	0. 344	0.374	0.363	0.168	0.267	0.245	0.393	0.311	0.307
Extremity of construing	0.142	0.320	0.311	0.024	0.209	0.358	0.430*	0.370	0.320	0.112	0.393	0.370
Extremy of Present Self	0.452*	0.614**	0.544**	0.388	0.495*	0.552**	0.360	0.347	0.597**	0.477*	0.509 *	0.560**
Extremity of Present Body	0.346	0.325	0.397	0.184	0.455*	0.339	0.382	0.265	0.382	0.328	0.371	0.378
Extremity of Self as other see me	0.279	0.387	0.308	-0.022	0.315	0.392	0.540**	0.242	0.370	0.131	0.459*	0.355

Note. DT Drive for Thinness; LSE Low Self-Esteem; PA Personal Alienation; II Interpersonal Insecurity; IA Interpersonal Alienation; Id Interoceptive Deficits; ED Emotional Dysregulation; P Perfectionism; A Ascetism; MF Maturity Fears; IC Ineffectiveness Composite; IPC Interperosnal Problems Composite; GPMC Global Psychological Maladjustment Composite. * Pearson Correlation; p Asymp. Sig. (2-tailed) *p<.05.**p<.01.***p<.001

Highlights

- This study combines measures of behavior and personal constructs in anorexia nervosa (AN)
- Anorexic patients showed impairments in spatial cognition and extreme, undifferentiated construing, particularly of the self.
- This unique impairment in the construction of identity might constitute the core symptom of AN.