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Opposite asymmetries in blind locomotor orientation of patients with panic agoraphobia compared to those with generalized anxiety

János Kállai [a,*], Zsófia Szabados [a], József Varga [a], Károly Ozsváth [a], Péter Molnár [b], György Kóczán [a]

[a] *Department of Psychiatry and Medical Psychology, University Medical School, POTE 7623, Pécs Rét st. 2, Pécs, Hungary*
[b] *Institute of Behaviour Science, Semmelweiss Medical University, Budapest, Hungary*

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Abstract

Panic agoraphobic subjects constantly struggle with the accurate registration of everyday space-time dimension. They are hindered in the exploration of their surroundings by constant self-directed attention. In our investigations we examined whether during experimental goal-directed locomotion orientation insecurity would appear. The accuracy of target-directed motion, i.e. the degree of lateral deviation, was recorded in three diagnostic groups, panic agoraphobics (15 subjects), generalized anxiety patients (15 subjects), and normal controls (15 subjects). According to our results the approach vector of the panic agoraphobics deviated to the right, while in the case of generalized anxiety patients it deviated to the left, while normal controls did not deviate significantly from the middle line. Results are compatible with previous literature which associated panic with an overactivity of left-sided functions, and generalised anxiety with an overactivity of right-sided functions.

Keywords: Panic; Agoraphobia; Functional cerebral asymmetry; Exploration; Fear; Spatial orientation

1. Introduction

Locomotion, seen as part of a set of goal-directed behaviours, is organized primordially and automatically, but in part is under direct conscious control, and therefore is a complex intermodal function built on higher integration levels. Spatial orientation is also an inherent part of personality. It offers orientational signs concerning the immediate environment including the continuous spatial relationship between objects and experiences. Furthermore, it provides on-line information on the immediate environment to include the spatial relationship between people and objects. This information forms the basis of the individual's frame of reference for the visual-postural body schema which organizes locomotion. In the early stages of ontogenesis, exploratory activity automatically generates a frame, a non-Euclidean individual space. The final stage in the individual's development represents the appearance of the loco-

* Corresponding author.

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motor field (Scheerer, 1986), determined by Euclidean metrical coordinates. It functions under the control of the minor brain hemisphere, although the intensity of function dominance between the hemispheres has not yet been elucidated (Paillard, 1991).

Following the psychophysiological work of Jacobs and Nadel (1985), the present study focuses on phobic patients' spatial orientation. Jacobs and Nadel found a spatial representation abnormality in phobic patients' behaviour. Empirical studies of panic agoraphobic patients' behaviour conducted by the authors of the present study gave similar results (Kállai et al., 1995).

Dysfunction of the spatial representation capacity of panic agoraphobic individuals, compared with normal controls and generalized anxiety patients, requires further investigation, having been demonstrated by data on spatial orientation disturbances and data stemming from experiences during psychotherapy (Kállai and Molnár, 1990). Earlier findings of the authors suggested that panic agoraphobic patients were easily lost in a maze. In spite of the fact that they had been guided through the maze just a minute before, they were able neither to recall the correct way nor even to give superficial verbal accounts of the path. They could name only a few orientation points which had been inadequate for the successful completion of the maze. All the available data lead us to the conclusion that panic agoraphobic patients appear to have insufficient orientation information for a self-confident passage through the maze.

Purposeful movement is guided by visual control which is the most important source of information from the point of view of orientation (DeRenzi, 1982). On studying spatial orientation, if visual control of an action is hindered, the main orientation toward the goal will be provided by the vestibular modality. That is, if the individual chooses a point to which s/he wishes to move, s/he will fix it with his eyes and will direct his body straight towards the chosen point. This activity will be successful if s/he moves straight along the chosen path. To reach a specific goal, movements must be under visual control, or, if this is not possible, in some instances the postural position must be maintained during motion. If the vestibular system is malfunctioning, a deviation from the straight line and inability to reach the ahead lying goal will be expected.

2. The proposed problem

If agoraphobic patients, compared with control and generalized anxiety patients, possess impeded orientation skills during a real-life situation, this orientation deficit will be supposed to appear under less complex circumstances, failing basic orientation points, similarly to the real-life situation. In investigating goal-directed behaviour during locomotion it was supposed that the inaccuracy of goal identification reflects the individual's orientation ability, which can be approximated by the distribution of mistakes plotted on a chart after repeated trials. Lower deviation scores represent a better actual orientation capacity of the subjects, while higher deviation scores mark a lower actual orientation capacity.

3. Subjects

45 subjects diagnosed according to DSM III-R were included in the experiments. 15 panic agoraphobics (mean age 39.4 years, range 24 to 45, male-female ratio 3:12, academic grade score average 2.1), 15 general anxiety patients (mean age 36.5, range 22 to 51, male-female ratio 3:12, academic grade score average 2.1) and 15 normal volunteers sorted on age and schooling (mean age 33.8, range 23 to 47, male-female ratio 3:12, academic grade score average 2.1) participated in the experiments. [1] Following the investigation, each individual completed the Beck Depression Questionnaire (Beck et al., 1961), the Spielberger (STPI) Anxiety, Anger and Curiosity Questionnaire (Spielberger et al., 1980, Hungarian form: Sipos and Sipos, 1983), the Panic Symptom List (American Psychiatric Association, 1987) and finally the Fear Survey Schedule FSS-III (Arrindel, 1980).

4. Methods

Oricntation skills were measured through diminishing cues needed for appropriate orientation. The

[1] Health criteria, a negative psychiatric history and the Eysenck EPQ (Hungarian standard, Eysenck and Matolcsi, 1984) as well as the emotional lability had scores under the standard values.

investigator led the subject into a 6 × 6-m empty room. On one of the walls, exactly at middle-chest height, there was a 50-cm long and 3-cm wide easily distinguishable line. Next, the subject was placed on a previously determined spot, at a distance of exactly 6 m from the point on the wall, and was asked to point to the mark on the wall with his right index finger. Next, the individual was blindfolded by special eye-glasses that obstructed the view in all directions, and then s/he was instructed to point again with the right index finger to the location where s/he believed the point was and, to approach this by small steps forward and to touch the point. Next, the subject was instructed not to remove the blindfold, and was led back to the starting point where the blindfold was removed, and again observed the point and was asked to repeat the procedure.

The trials were averaged and plotted without the possibility for correction, and the deviation pattern was utilized for demonstrating the extent of the individual's orientation skill and goal-directed behavioural abilities. [2]

5. Data processing

The basic dimension forming the locomotor field of orientation was defined as a half circle, at the origin of which we placed the experimental subject. The goal was directly in front of him and formed a 90° angle to the subject. If the subject moved left of the target, then the deviation was greater then 90°, while if s/he moved right, the deviation was less than 90 degrees with regard to the deviation vector away from the target. Consequently, all deviations from a straight line demonstrated the degree of the locomotion vector. The utilized statistical program package was SPSS/PC Analysis of variance (1987).

6. Results

Comparisons between the groups are shown in Table 1 for the Personality traits. Emotional lability as expected was more intense in the panic agoraphobic group. The desire for adventure, the tendency for increased excitement, and seeking positive reinforcement – features assigned to extraversion – demonstrated no differences between the groups.

For the generalized anxiety patients, the results were similar to the panic agoraphobic patients' results, namely, despite higher emotional lability, general anxiety patients proved not to be more introverted than normal subjects. The two patient groups did not differ on Emotional lability or Extraversion.

The Beck Depression Scale is a widely used experimental instrument nowadays and biochemical associations underlie its utilization in both panic agoraphobia and depressive states. Comparing the panic agoraphobics with normal controls, depression was higher in patients. Similarly to panic agoraphobics, generalized anxiety patients' depression values were significantly higher than those in normal healthy individuals. There was no difference between the panic agoraphobic and generalized anxiety groups in depression.

Comparing panic agoraphobics with normal control subjects (Table 1) on anxiousness, curiosity, and anger, panic agoraphobic subjects generally experienced more anxiety in everyday situations and showed less interest towards their surroundings. Concerning anger, panic agoraphobic subjects did not differ from the normal controls. Concerning anxiousness and curiosity, generalized anxiety subjects also differed from the healthy controls. Interestingly, no characteristic differences appeared between panic agoraphobic and generalized anxiety patients, concerning anxiousness and its accompanying anger and curiosity traits.

Considering the relationship between fear avoidance and the frequency of panic (Table 1), behaviour avoidance: $F = 5.7729$, $p < 0.05$, was more intense among panic agoraphobics than among generalized anxiety patients. The frequency of panic symptoms was also higher among panic agoraphobic subjects: $F = 11.3678$, $p < 0.01$. Considering both behavioural avoidance and the frequency of panic, the comparison with control subjects produced the following diagnostically significant differences: avoidance: panic agoraphobia vs. control – $F = 25.88$, $p < 0.001$.; generalized anxiety vs. control – $F = 7.42$, $p < 0.05$.; frequency of panic: panic agorapho-

[2] Subjects who usually use their left hands for eating, pointing, aiming (ball throwing) in everyday-life were excluded from the experiment.

Table 1
Trait, state and symptoms differences between panic agoraphobic, generalized anxiety and normal control subjects

	Panic agoraphobia vs. normal control			Generalized anxiety vs. normal control			Panic agoraphobia vs. generalized anxiety		
	mean	SD	*F*-ratio	mean	SD	*F*-ratio	mean	SD	*F*-ratio
EPQ emotional lability	18.93	2.5		18.20	4.5		18.93	2.5	
	7.73	3.8	87.8470 ***	7.73	3.8	46.6332 ***	18.20	4.5	0.3041
EPQ extraversion	10.73	4.8		10.86	3.9		10.73	4.8	
	13.00	3.2	2.3306	13.00	3.2	2.7018	10.86	3.9	0.0070
Beck depression	17.73	6.1		21.60	8.6		17.73	6.1	
	5.26	3.1	51.0071 ***	5.26	3.1	47.8617 ***	21.60	8.6	2.0223
STPI trait anxiety	28.60	5.3		29.26	5.1		28.60	5.3	
	19.20	3.6	32.3268 ***	19.20	3.6	38.5990 ***	29.26	5.1	0.1234
STPI curiosity	25.13	5.1		26.26	4.5		25.13	5.1	
	31.06	4.2	12.2265 ***	31.06	4.2	9.1660 **	26.26	4.8	0.4223
STPI anger	24.40	5.5		25.66	4.9		24.40	5.6	
	22.73	5.8	0.6463	22.73	5.8	2.2523	25.66	4.9	0.4416
Avoiding behaviour	247.1	27.5		223.6	25.8		247.1	27.5	
	198.5	27.7	25.8890 ***	198.5	27.7	7.4286 *	223.6	25.9	5.7759 *
Panic frequency	74.66	16.8		56.46	12.8		74.66	16.6	
	30.73	8.6	82.8509 ***	30.73	8.6	41.9285 ***	56.46	12.8	11.3678 **

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

bia vs. control – $F = 82.85$, $p < 0.001$.; generalized anxiety vs. control – $F = 41.92$, $p < 0.001$.

Blind orientation (Table 2) was reduced to degrees of deviation, and the trials were registered on a 180° half-circle. The calculations were determined by the average of the three trials, namely, by the direction of the deviation of the subjects' index fingers away from the predetermined target.

The following group comparisons were significant: panic agoraphobic and control subjects ($F = 6.1702$, $p < 0.01$); generalized anxiety and control subjects ($F = 5.5967$, $p < 0.05$); panic agoraphobic and generalized anxiety patients ($F = 16.1785$, $p < 0.001$). Thus, based on the results of the accuracy average, that is, the level of deviation away from the target, the three groups were differentiated from each other. The averages are shown in Fig. 1.

The experimental subjects faced directly the target at a distance of 6 m. Left deviations included more

Table 2
Blind orientation during goal directed locomotion. The mean goal missing rate from the real target point (in degrees)

	Mean	SD	SE	*F*-ratio	Significance
Panic agoraphobia vs.	86.93	2.48	0.64		
normal control	88.84	1.64	0.42	6.1702	$p < 0.01$
Generalized anxiety	90.83	2.81	0.72		
vs. normal control	88.84	1.64	0.42	5.5967	$p < 0.05$
Panic agoraphobia vs.	86.93	2.48	0.64		
generalized anxiety	90.83	2.81	0.72	16.1785	$p < 0.001$

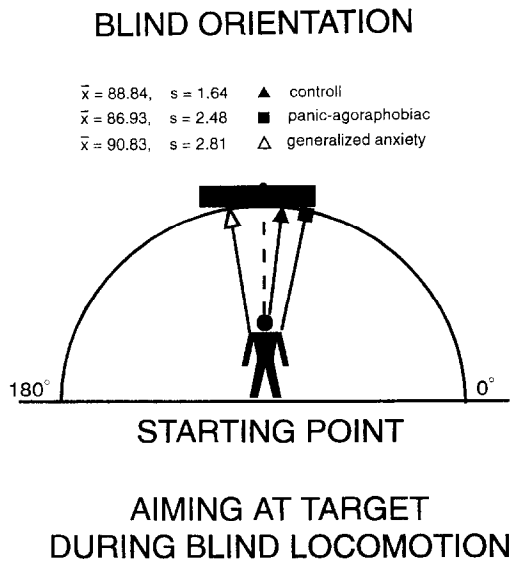

Fig. 1. Level of deviation away from the target; differentiation of the three groups.

than 90° and right deviations less than 90°. For visual purposes, diagrams were plotted which helped to observe the positional vectors of the actual directions. As the diagram indicates, the healthy control subjects moved repeatedly closest to the predetermined target. Noteworthy is the fact that panic agoraphobics – compared with the normal control subjects – showed a right deviation, while general anxiety patients demonstrated a left deviation.

7. Discussion

During the 'Blind Orientation' trials it was found that the panic agoraphobic, generalized anxiety and normal control subjects tended to have characteristic failures. They made mistakes during the target-finding motion as reflected in the locomotion vector as well as in the spontaneous target missing vector. Panic agoraphobics in comparison to either generalized anxiety patients or normal controls demonstrated a right deviation from the target. Empirical consideration of the deviations from the target suggested that generalized anxiety patients deviated to the left side and normal control subjects deviated slightly to the right, while panic agoraphobics significantly deviated to the right side.

A close analysis of these findings raise two problems. Firstly, as was mentioned earlier, the target-aiming disturbance came from personal sensory distortions. Secondly, the distortions appeared not only in perception, but also during the habitual, automatic behavioural functions. Postural body schema disturbances and vestibulo-cortical deviations equally could alter locomotion toward the target, which was otherwise devoid of visual control.

In an earlier study, the experimental subjects also took part in an additional experiment, in which we examined their attention as well as orientation ability and so additional information helped with the question of validity (Kállai et al., 1995). The data so obtained indicated that the lateral deviation of the vector correlated directly with the values obtained during the directional sense measurement of spatial orientation. Therefore, comparing the panic agoraphobics with generalized anxiety patients and normal controls, those in the former group did not only get lost easier, but also paid less attention to their environment with the consequence that they constructed an incomplete cognitive map of their vicinity. Therefore, in response to their visual orientation they deviated to the right of the predetermined target directly in front of them. Normal controls and generalized anxiety patients with their more accurate spatial orientation deviated left from the target instead. Thus, the accuracy of the orientation ability and the target directed locomotion vector, devoid of visual control, showed specific relationships.

What does this relationship indicate? One possibility is that the doubtful orientation ability and the inaccurate target directed locomotion arose from a weak spatial memory. This may seem true concerning spatial orientation, but it fails to explain the mistakes made during the blind locomotion. Since the mistakes here represented functions of groups with specifically diagnosed conditions, and appeared as deviations in one direction or another, they were not caused by spatial memory failure but rather by the representation of the spatial experience, so that they must have existed in the mode of representation.

In relation to the storage of spatial information, two closely associated functions play an important role, the sensory motor processing system, whose reference-frame is egocentric, and the representation processing system, whose reference-frame is allocentric, (Paillard, 1991). Through direct interactions with the environment the sensory-motor processing system controls the constant recording of the changes elicited by the specific action and also constantly corrects goal-directed motion. The representation system works through the processing of neural actions, i.e. already existing inner experiences. It functions through preformed regulations which are ensured by constant environmental conditions and maintained by the relative continuity of the cognitive map of the action. The objective space is constituted by directional vectors which are produced by the processing of information about the immediate vicinity as a result of the action of both of the separate reference-frames (Paillard, 1991). It seems that during the processing spatial information in the chosen experimental situation, light is shed on the panic agoraphobic individuals' unique spatial-construction process.

The data in the present study support the association of different anxiety states with hemisphere later-

alization, especially that based on the work of Gruzelier (1989). Different forms of anxiety have been classified according to physiological and biochemical bases established by means of high-tech diagnostic instruments. Mainly on the grounds of positron emission tomography (PET), cerebral blood perfusion measurements with panic and other anxiety states have been localized to the right parahippocampal region (Reiman et al., 1986, 1989). A detailed overview of the subject concerning the results of an electrodermal investigation of anxiety, habituation and reaction time is given by Gruzelier (1989), as well as by Kopp et al. (1987) and Kopp and Gruzelier (1989).

During psychophysiological investigations of anxiety, Kopp and Gruzelier (1989) examined the electrodermal difference among normal, generalized anxiety and panic agoraphobia patients, by measuring electrodermal response amplitudes on both hands simultaneously. This disclosed a predominantly right hemisphere stimulation in the generalized anxiety patients compared with the panic agoraphobics. The results of Gruzelier (1989) are consistent with the findings and strengthen the belief that anxiety can be divided into two subgroups: generalized and panic anxiety, which are located to opposite hemispheres. Panic anxiety is mainly localized in the left hemisphere and is characterised by pondering and forced thoughts which are followed by over-emphasized cognitive symptoms, while generalized anxiety is more characteristic of the right hemisphere and is related to a non-verbal, free-floating anxiety, emotional lability and hypervigilance. Gruzelier (1989) suggests that panic anxiety provides left hemispheric solutions to the individual problems, whereas, in the case of generalized anxiety there is a right hemispheric cognitive mode. The results and conceptions of Gruzelier were recently supported by computer tomographic examinations and by electrodermal activity differences (Jutai, 1984; Reiman et al., 1989; Kopp and Gruzelier, 1989).

In conclusion, during the blind-orientation trials the panic agoraphobics, as well as the generalized anxiety patients had opposite vector deviations away from the target. We propose that the different locomotion vectors relating to the spatial field demonstrate the subjects' different underlying hemispheric utilization. The blind trials have uncovered an asymmetry in neuronal computations and representations of space. The everyday life of the panic agoraphobics is made unbearable by the avoidance of specific goals and by the constant fear of being unable to escape. The authors propose that during the neuronal computation the malfunctioning of the left hemisphere gives rise to the right-sided avoidance motion as seen in the investigated paradigms.

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