

# Does Movement Behavior Have Differential Diagnostic Potential? Discussion of a Controlled Study on Patients with Anorexia Nervosa and Bulimia

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The present study investigated the movement behavior of patients with anorexia nervosa and bulimia nervosa using two groups of patients with inflammatory bowel disease and healthy subjects as control groups. There were significant differences between the patient groups on one hand, and the healthy controls on the other in several movement parameters such as area of movement, weight shift, use of the body parts, integration of the lower body, initiation of movement, strength, and flow of movement. Surprisingly, there were no significant differences among the four patient groups. Significant differences may be found when investigating movement parameters in combination, not alone. The discussion focuses on the methodological question of whether movement behavior has differential diagnostic potential for mental disorders.

## Introduction

In the present study, the aim was to investigate whether there are specific movement characteristics for the diagnostic groups anorexia

nervosa and bulimia. Different aspects of the movement behavior of patients with anorexia, and more rarely, those with bulimia have been reported in the literature. Quantitative abnormalities of movement behavior such as hyperactivity have often been described for these patients (Blinder, Freeman, & Stunkard 1970; Kron, Katz, Gorzynski, & Weiner, 1978; Beumont, Arthur, Russell, & Touyz, 1994; Davis, Kennedy, Ralevski, & Dionne, 1994; Brewerton, Stelfox, Hibbs, Hodges, & Cochrane, 1995; Davis, 1997). In addition, qualitative movement characteristics in patients with anorexia nervosa have been the subject of several empirical studies. Burn (1987) found that anorectic patients had less free movement flow, less flow from upper to lower body, more peripheral movement initiation, and more sustained movement than healthy controls, and Lausberg, von Wietersheim, and Feiereis (1988) observed that patients with anorexia displayed a preference for quickness and moving in the upper level when compared to a heterogeneous group of patients with psychosomatic disturbances. Shenton (1990) reported the use of bound flow, a limited use of the weight effort, and a distorted use of space and time in patients with anorexia. Even an investigation of neurological movement categories revealed dysdiadochokinesis in anorectics, which is an impaired ability to perform rapid alternating movements (alternating agonist/antagonist innervation equivalent to the Laban category flow) (Gillberg, Rastam, & Gillberg, 1994). The dysdiadochokinesis remained even after improvement of eating behavior. Given the range of movement behaviors reflected in these findings, and the potential of movement characteristics to provide objective behavioral data, it follows that information on specific movement characteristics of patients with eating disorders might be used to gain a better understanding of these disturbances. This information might be used to elaborate more effective diagnostic and therapeutic methods in dance therapy.

## Method

This study examined 120 women including in-patients diagnosed with anorexia nervosa ( $n=30$ ), bulimia ( $n=30$ ), two types of inflammatory bowel disease, Crohn's disease ( $n=11$ ) and ulcerative colitis ( $n=19$ ), and healthy control participants ( $n=30$ ). Each participant performed a 10-minute movement test, consisting of structured movement tasks and improvisation which was videotaped. Videotapes were assessed by two independent raters using specific rating criteria designed for movement behavior.



### Test Design

The movement test consisted of a 10-minute two-part movement test with verbal instructions given by a test supervisor. Part 1 included the tasks: walking (30 s), running (30 s), jumping (30 s), stamping (20 s), contraction—expansion (30 s), standing on the balls of the feet (15 s), swinging (30 s), spinning/turning (30 s), and falling to the ground (30 s). Part 2 used improvisation tasks with the themes water, fire, air, and earth. A minute was given for each dance improvisation.

In part 1, the ability to execute certain movement qualities was tested by the performance of the movement tasks and evaluated on the basis of defined standards. For example, the stamping task which used the directive, "stamp as hard as you can," tested the use of force and directness. In addition to recording certain movement skills, part 1 was intended to act as the physical and psychological preparation for the improvisation in part 2. The participant was physically prepared by the gradual increase of physical activity (walking, running, jumping, stamping), the concentration and coordination phase (contraction/expansion, standing on the balls of the feet), and the loosening and relaxation phase (swinging, spinning/turning, falling). Because part 1 allowed time for adjusting to the test situation, it also served as a psychological "warm-up." This is especially necessary due to the potentially confrontational and stressful situation of moving alone in front of a video camera. The simple, structured movement tasks in part 1 were intended to give the participant a feeling of security ("I know what I have to do") and success ("I can perform the task"). It was hoped that this rather supportive beginning of the test would promote the development of creativity desired in the improvisation.

For these goals, the movement tasks were selected from the literature using the following criteria: a) performing the task should not require sophisticated motor abilities, b) it should be possible to observe individual differences on the movement task, and c) it should be possible to clearly describe the movement task verbally so that differences in execution due to misunderstanding are eliminated. The function of each movement task for the research design is explained in more detail below. The actual test instructions are located in Appendix A.

*Walking.* Walking is the first movement task. As the basic form of locomotion familiar to everyone, it should facilitate entry into the testing situation. In general, walking is frequently used in movement analysis (Kietz, 1952; Schoop, 1974; Wallbott, 1982; Espenak, 1981). In this study, it also served to facilitate the observation of movement in space.

*Running.* Running fulfilled the same function as walking. As a more dynamic form of walking, it also results in a gradual physical warm-up.

*Jumping.* The warm-up was continued by jumping as a more dynamic form of running. Moreover, as noted by Schoop (1974) and Espenak (1981), the emphasis of the jump and the time in the air can be evaluated as they were in this study.

*Stamping.* Stamping follows walking, running, and jumping as a further task of locomotion. The energy level in stamping is about the same as jumping, but the direction of force (downward) is exactly the opposite to jumping (upward). The greatest possible force in one place can be generated if, in addition to muscle strength, one's entire body weight is used and the foot is brought directly to the floor by the shortest distance.

*Contraction/Expansion.* This task was chosen based on the recommendations of Schoop (1974), Laban (1988), and Bernstein (1991). It becomes clear with this movement task whether a person prefers contracting or expanding. As contraction/expansion promotes sensitivity for the body center (to the middle/from the middle), it can prepare the mover for the following balancing exercise.

*Standing on the Balls of the Feet.* Performing this task requires balance which is a condition of centering (i.e., being conscious of the relationship between the center and the supporting point of the body) (Schoop, 1974; Espenak, 1981). Balancing prepares the subject for the following, more complex movement tasks.

*Swinging.* With swinging, there is a change between tension and relaxation in the movement flow of the entire body. Fluctuations of tone modulation, such as, too much or too little, and muscular tension, impede the execution of swinging (Schoop, 1974; Espenak, 1981).

*Spinning.* Spinning can lead to an ecstatic state (Akstein, 1981). If this is the aim, then the spinning movement must first be accelerated and then continued at a constant rate. However, in the present study the purpose of spinning was to observe the mover as spatial orientation was given up and free flow movement was used.

*Falling.* To fall requires uniform, successive relaxation of the body. Due to this aspect of the movement, the task was considered a continuation of swinging and spinning. In part 2, the improvisations were intended to give an impression of the subject's spontaneous repertoire. Im-



provisation with given topics was preferred over free improvisation (without themes given) for the purposes of this study. The results of a pilot study (Lausberg et al., 1988) with free improvisation (task instruction: "Try to express in movement how you are feeling. Act spontaneously.") showed that complete freedom in the examination situation has an inhibitory effect on creative movement. Thus in the present study, the participants were given a supportive structure for orientation via improvisation themes. It was desired that the participant's movement behavior should be determined as little as possible by the actual improvisation topics. To address this concern, the choice of improvisation themes was modeled on Schoop's (1974) theme "depicting the ocean." It not only suggests dynamic action but also offers a large scope of projection (the ocean can be calm, bubbling, refreshing, dangerous, etc.). Analogously, the theme "water" was selected for this study, since it allows even more improvisation possibilities (water can be an ocean, river, spring, pond, tap water, etc.). To encourage variations in the movement dynamics, the improvisation themes "fire", "air", and "earth" were also added. These are themes that may stimulate certain emotions due to their symbolic content (Anderten & Riedel, 1993). Since these four topics are traditionally thought of as the symbolic group "The Four Elements," a certain completeness can be assumed that may be extended to emotional and movement associations. Hence, a broad scope of movement may be observed with the four different improvisations.

All videotapes were made in the same room with the same equipment. The examination room was a therapy room in the Department of Psychosomatics and Psychotherapy of the Medical School of Lübeck. The video camera was visibly installed on the ceiling of the examination room and recorded the entire 40 m<sup>2</sup> movement area which was bounded by chairs. The test supervisor was a dance therapist and had no contact with the patients other than the preliminary conversation before starting the study.

### *Rating of Movement Behavior*

Laban movement analysis (LMA) was used as the basis for the selection of movement parameters because its observational categories are well defined and largely objective. The broad spectrum encompassed by LMA makes it particularly important for basic research in movement description, allowing a systematic search for movement characteristics. LMA also provides comparative data for scientific studies, since it is the standard system for movement analysis in dance therapy. LMA parameters selected for this study included those that demonstrated good reliability,

as well as differences between patient groups in the pilot study (Lausberg et al., 1988) and the study by Burn (1987). Moreover, movement parameters were selected on the basis of personal observations and references in the literature (Schoop, 1974; Dell, 1977; Davis, 1978; Espenak, 1981; Burn 1987; North, 1990) that seemed to be useful for the investigation. In addition to the LMA characteristics, the rating scales also included a number of movement characteristics that proved to be suitable in the pilot study (Lausberg et al., 1988).

The rating scales were designed differently for the two-part test design. The rating scales for part 1 consisted of rating specific movement qualities per unit of time for the specific movement tasks (e.g., the parameter strength for the stamping task; kinesphere for the contraction-expansion tasks; balance when standing on the toes/balls of the feet; flow and continuity in turning/spinning; and flow and end position when falling to the ground). The rating scales for improvisations in part 2 which are described in more detail below, included movement parameters for recording the individual features of the presented movement, floor contact, level, movement area, kinesphere, weight shift, body involvement, and body half. Each parameter was evaluated four times in part 2, once for each improvisation task. The four-fold assessment was advantageous because the evaluation of the test participant becomes more reliable with regard to the movement parameters (offering evidence of retest reliability).

All of the movement parameters were operationalized as ordinal scales. According to the classification and recommendation of Faßnacht (1979), the "method of rating" chosen for both parts of the test was parameter rating per time unit. Bipolar movement parameters (e.g., kinesphere: small to large) were operationalized as three-, four-, or five-grade ordinal scales. The four-grade type (e.g., small, small to medium, medium to large, large) was preferred, since it requires the rater to favor one or the other pole. Each parameter grade was defined and differentiated from the other, for example, movement area coded for an improvisation from part 2 referred to the extent of the area in the room which was used for the movement performance. It did not matter whether the participant used the perimeter of the area, for example moving in a large circle, or the inside of the area. The four grades for movement area were defined as follows: 1) small: there is no locomotion while moving, 2) small-medium: the movement area is not larger than the reach of the arms (e.g., on average 1.5 m<sup>2</sup>), 3) medium-large: the movement area is larger than grade 2 and smaller than grade 4, 4) large: the subject uses the total of the dance floor for the improvisation.

Some bipolar parameters did not allow meaningful intermediate stages, for example, gesture and weight shift. Both polar qualities may simultaneously occur in practice, with weight shift accompanying simultane-



ous arm gesture. For these movement parameters in part 2 of the test, a combination of the "method of rating" (coding degree of each movement quality per time unit) and the "method of time-sampling" (recording the duration of the occurrence of each quality per time unit) (Faßnacht, 1979) was used. Thus, a five-grade scale was chosen which referred to the ratio of the two qualities A:B (e.g., grade 1 = 100% of the time quality A; grade 2 = 75% of the time quality A + 25% of the time quality B; grade 3 = 50% A + 50% B; grade 4 = 25% A + 75% B; grade 5 = 100% B).

Coding units were identified by the duration of the movement tasks lasting 15 to 60 seconds. The suggestion of Innerhofer (1981), who recommended a time frame of 3 to 45 seconds for coding movement behavior, was used as a guide for determining the coding units.

The video recordings were evaluated by two independent raters using the rating scales. The raters, dance therapists with knowledge of movement analysis, were blind to the diagnosis of patients and control participants, and had no knowledge of the hypothesis of the study. They were trained using 14 test videotapes, and rater training lasted about 35 hours.

### Participants

A total of 120 females aged 15–45 years (mean age 25 years) participated in the study. Participants with anorexia nervosa and bulimia nervosa were diagnosed using *DSM III-R* criteria (American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, 1987). Participants included patients with anorexia nervosa ( $n=30$ ), bulimia nervosa ( $n=30$ ), Crohn's disease ( $n=11$ ), ulcerative colitis ( $n=19$ ), and 30 healthy controls. The patients were recruited from the in-patient Department of Psychosomatic Medicine and Psychotherapy of Lübeck Medical University, which admits individuals who are diagnosed as having anorexia nervosa, bulimia nervosa, or inflammatory bowel disease, who are without psychosis and do not require confinement to intensive care. Patients with inflammatory bowel diseases were chosen as diagnostic control participants because they represent a diagnostic group which is treated in the same department as the patients with eating disorders, their disease also deals with the gastro-intestinal system in the broader sense, and psychosocial factors are also discussed in the etiology of inflammatory bowel diseases. The healthy control group was selected from among the female staff of the Department of Psychosomatic Medicine and Psychotherapy of Lübeck Medical University.

Exclusion criteria were no further psychic or somatic illness apart from the primary diagnosis, intellectual impairment, confinement to

bed, parenteral or tube nourishment, anus praeter, or other somatic complaints that could influence movement behavior (e.g., fractures).

All female patients with appropriate disorders and all female staff members between the ages of 15 and 45 were asked to participate in order to avoid selecting only those who liked to dance, allowing a more representative sample. In each group, two to three persons refused to take part in the study. The groups were well matched for age, with the mean age of 23.1 years in the anorexia nervosa group, 23.4 years in the bulimia nervosa group, 28.5 years in the Crohn's disease group, 26.0 years in the ulcerative colitis group, and 27.2 years in the healthy control group.

## Results

Interrater reliabilities for the movement items ranged from 0.53 to 0.87 with a mean value of 0.67 using Cohen's weighted kappa (Cohen, 1968). Table 1 displays the values of kappa for each item in parts 1 and 2 of the

**Table 1**  
**Values of Cohen's Weighted Kappa Between Raters for Each Movement Item in Part 1 and Part 2 for the Fire Improvisation**

<i>Movement Task/Item</i>	
Part 1	
Stamp/strength	.75
Co/kinesphere	.58
Ex/kinesphere	.87
Co-ex/kinesph.	.67
Toes/balance	.53
Turn/flow	.58
Turn/contin.	.80
Fall/flow	.66
Fall/endpos.	.70
Part 2	
Floor contact	.62
Level	.65
Movement area	.82
Kinesphere	.72
Weight shift	.67
Body involvement	.55
Body half	.66



Table 2  
Means for Standardized Movement Tasks with Significant Differences  
Among the Groups

Movement Task/ Movement Item	A	B	C	U	H
Stamp/strength	2.2	2.3	2.4	2.3	3.2***
Co/kinesphere	1.3	1.3	1.4	1.4	1.2
Ex/kinesphere	3.6	3.8	3.9	3.8	3.9
Co-ex/kinesph.	3.3	3.5	3.5	3.4	3.7
Toes/balance	2.9	3.1	2.5	2.9	2.9
Turn/flow	2.2	2.3	2.0	2.2	2.9**
Turn/contin.	2.4	2.3	2.4	2.2	2.1
Fall/flow	2.0	2.4	2.4	2.2	3.3**
Fall/endpos.	2.4	2.4	2.0	2.3	2.7

Note:

A = anorexia; B = bulimia; C = Crohn's disease; U = ulcerative colitis; H = healthy control group. Co = contraction; Ex = expansion. Probability values: \*\*p < .01; \*\*\*p < .001 for Kruskal-Wallis H-test.

test. As the comparisons among the study groups were performed on ordinally scaled items, a non-parametric statistical test, Kruskal-Wallis one-way analysis of variance, was applied. Because this is a test for multiple groups analogous to one-way ANOVA, post hoc tests were required for statistically significant results. The Mann-Whitney U was used as the post hoc test for investigating significant differences between pairs of participant groups.

Significant differences in movement behavior among the groups were found on 3 of the 9 movement items in part 1 of the test. Means for each group on these items are displayed in Table 2. Significant differences among the examination groups were found on the tasks of stamping, turning, and falling. The Mann-Whitney U test was used to locate the significant differences between the groups. All significant differences occurred between the patient groups and the healthy control group.

The results of the improvisation tasks from part 2 of the test are given in Table 3. As there were similar findings for all four improvisation tasks, only the results of the task "fire" are included in Table 3. Significant differences among the groups were found on the items movement area, weight shift, body involvement, and body-half preference. Again, results of the Mann-Whitney U tests used to locate the significant differences between the groups, showed that all significant differences occurred between the patient groups and the healthy control group. Specifically, patients with anorexia nervosa, bulimia nervosa, or the two groups with inflammatory bowel disease had significantly smaller mean

Table 3  
Means for Improvisation Task "Fire" with Significant Differences  
Among the Groups

Movement Item	A	B	C	U	H
Floor contact	2.1	2.0	2.3	2.1	1.9
Level	3.6	3.6	3.4	3.9	4.1
Movement area	1.7	2.0	1.8	1.8	2.8**
Kinesphere	3.7	3.8	3.5	3.8	3.8
Weight shift	1.7	2.1	2.2	2.0	2.8***
Body involvement	2.7	2.8	3.0	2.4	1.9***
Body half	1.9	2.1	1.8	2.1	2.8**

Note:  
A = anorexia; B = bulimia; C = Crohn's disease; U = ulcerative colitis; H = healthy control group.  
Probability values: \*\*p < .01; \*\*\*p < .001 for Kruskal-Wallis H-test.

areas of movement than the healthy individuals. No significant differences were found among the patient groups.

## Discussion

The results revealed significant differences between the patient groups and the healthy controls on several movement parameters such as area of movement, weight shift, use of the body parts, integration of the lower body, initiation of movement, strength, and flow of movement, but no significant differences among the four patient groups. Because the impact of the differences between the patient groups and healthy controls has been discussed in a previous article (Lausberg et al., 1996), the following discussion focuses on the absence of significant differences among the patient groups.

One possibility for the lack of significant differences among the patient groups is that the rating instruments were not sufficiently sensitive to register differences among the patient groups. Although many items had good rater agreement, some of the kappa coefficients indicate that particular movement items require more precise definition in order to improve interrater reliabilities. Lack of rater agreement can affect the power of a statistical test to detect significant differences, as can small sample size. While the samples of eating disorders patients were modest, the Crohn's disease group was rather small. Additionally, non-parametric tests of the type used to analyze the data are known to be less powerful than their parametric counterparts, and this factor could



have been responsible for the lack of significant differences between patient groups.

The test design used in this study was an improvement over that used in the pilot study. The participants showed more motivation to move alone in front of the videocamera compared to the participants in the pilot study, where some discontinued the test or did not move for the entire testing period. The better cooperation of the participants in the present study may have been due to the fact that the test situation was more structured in the present study. In addition to providing more structure, the revised test also included a greater number of different tasks. Compared to the pilot study in which only one improvisation task was given, the participants in the present study displayed more variety of movements due to the larger number of tasks (ten standardized movement tasks and four improvisation tasks) and the two different types of tasks used. The increased sampling of participants' movements revealed that participants displayed movement qualities in part 1 that they did not spontaneously use in the improvisation. Moreover, different movement qualities were also detected within the four improvisation tasks. However, it is possible that in spite of the improvements to the test design, its specificity may still be deficient.

The fact that significant differences in movement behavior were found between the patient groups and the healthy controls indicates that the test design and rating instrument were capable of the basic distinction between health and dysfunction, but were not useful in distinguishing among types of dysfunction. Also in other research studies performed relatively independently of each other, in fields such as psychiatry, psychosomatic medicine, dance therapy, nonverbal communication, and psychomotor therapy movement parameters have been found that correlate unspecifically with psychic dysfunction. For example, in depressed and schizophrenic patients, abnormal voluntary and involuntary movements (Owens, 1982; Rogers, 1985; Caligiuri, 1993; Chatterjee et al., 1995), psychomotor deficits, such as those found in dexterity or rhythm tasks (Wulfeck, 1941; King, 1954; Manschreck, 1985, 1989, 1990; Günther et al., 1991), qualitative changes in movement behavior (Jones, 1965; Davis, 1981; Wolf-Schein, 1985; Wallbott, 1989; Davis, Cruz, & Berger, 1995), and altered nonverbal behavior (Ekman & Friesen, 1974; Ulrich & Harms, 1985; Ellgring, 1985; Gaebel, 1992; Hadzi-Pawlovic, 1993) have been demonstrated. Using several categories of movement behavior, differences in the degree of the disturbance were found among different diagnostic groups such as schizophrenia, psychotic depression, and neurotic depression. However, no single qualitative parameter pathognomonic for a specific diagnostic group has thus far been established. Wolf-Schein (1985) and Manschreck (1989) who investigated patients with autism and schizophrenia, respectively, stated explicitly that they

detected no movement parameters that were specific for these diagnostic groups. As suggested by Wallbott (1989), one explanation may be that "movement characteristics are more indicative of the *degree* of psychopathology, and less of the *type* [italics added] of psychopathology" (p. 133).

On the other hand, Cruz (1995) found that patients with schizophrenia did not differ significantly from those with personality disorders on any single movement item, but rather on a cluster of items. Analogously, no single psychopathological symptom has thus far been identified that is pathognomonic for a diagnostic group, for example, depressive mood is found in bipolar disorders, obsessive-compulsive disorders, drug addiction, or bulimia. The specificity is rather to be found on the level of the *syndrome*. Cruz advised a change from univariate to multivariate statistical techniques for illuminating differences in symptomatology related to syndromes. Based on the fact that the statistical techniques in the present study were univariate rather than multivariate, I do not intend to conclude that there are no differences in movement behavior between patients with anorexia nervosa, bulimia, and inflammatory bowel disease. Instead, I tentatively propose that significant differences may be found when investigating movement parameters in combinations, which might include quantitative parameters such as hyperactivity. Further research concerning the diagnostic potential of movement behavior should focus on the syndromatic level in order to test this proposition.

### Acknowledgments

This study was supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Association). Data presented in this article have been previously published in *Psychotherapy and Psychosomatics* 1996, 65, 272-276. The study design manual (test instructions, rating scales with item definitions, instructions for raters) is available from the author. I am indebted to Ms. Pamela Glowacki for her help with the translation of this article and to Robyn Flaum Cruz for her assistance with interpretation of the statistical results.

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## Appendix A: Test Instructions

"I will give you some movement tasks which will be videotaped. The camera is up there. If you do not have any more questions, I will go and start the video.

Please start with walking. Always perform a movement task in the way you think it should be done, and always until I give you a new instruction. (30 s)

Please run. (30 s)

Please jump. (30 s)

Please stamp as hard as you can. (30 s)

Contract and expand several times. (30 s)

Please stop and elevate on the balls of your feet and try to stand there. (15 s)



Now try to stay on the ball of one foot and move the other leg away from the floor. (15 s)

Please swing with your upper body. (30 s)

Please spin around. (30 s)

And fall to the ground. Now you can relax for a while.

When you feel fit again, I will give you four more movement tasks. There you can move the way you want to. Just do whatever comes into your mind. Try to express 'water' with your body. You have one minute to try out different possibilities. (1 m)

Thank you. Now try to express 'fire' in your body movement. (1 m)

Thank you. Now try to express 'air.' (1 m)

Thank you. And now as the end of the test try to express 'earth'." (1 m)