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EXAMINING THE SPATIAL ORIENTATION OF FOLK DANCERS

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Abstract

In this paper, an empirical study on dancers' perception of body schema is presented, focusing on mapping the *forward middle* and *place high* directional perception of the participants. During the study, participants, comprised of 103 children, adolescents, and adults, performed arm movements in different body positions in the previously defined directions. The exercises were videorecorded on moving images and subsequently analysed using statistical methods. The selection of the sample was designed to obtain a diverse range of the participants' dance-related characteristics (i.e., years of experience in folk dance, professional versus amateur status, and exposure to Lábán kinetography). The research revealed that non-vertical body positions alter the dancer's internal directional reference system, and that learning Lábán kinetography has an effect on this system.

Keywords: body schema perception, empirical research, folk dance, Lábán-kinetography

1. INTRODUCTION

In my experience of teaching Hungarian folk dance and Lábán kinetography,[1] in several cases I have encountered varying interpretations from students. The *Go Forward* task, performed in a stage setting, is perceived differently depending on whether a dancer is facing toward or away from the audience. Similarly, in the dance studio, a teacher who is facing the students may confuse them by starting a rightward movement and verbally confirming a rightward direction. This occurs because in the student's own directional counting system, the teacher moves to the left. Even with professional guidance, students perform the task differently. Variability also appears when the direction shown by the teacher is interpreted differently by the students; for example, when a teacher tilts their torso forward horizontally and then moves their arms in a direction parallel to the ground, some students may perceive the arm's direction as be forward, while others may interpret it as high.

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[1] Lábán kinetography is a motion capture system named after its developer, Rudolph Lábán. Lábán kinetography emerged at the beginning of the 20th century as a means of writing down movements using symbols and is primarily used by dance researchers and dancers. Since 1959, the development and teaching of the system have been coordinated by the International Council of Kinetography Laban (Fügedi, 2011).

In this paper I empirically investigate the issues above among Hungarian folk dancers from the perspective of the three reference frames established in Lábán kinetography. The literature review will highlight previous research on spatial orientation and internal body perception. In regard to the latter topic, several studies of dancers were found; however, the directional systems outlined in Laban kinetography have not yet been researched in this context.

In the first hypothesis of my exploratory research, I posited that the participants' internal orientation system in Laban kinetography could be classified into well-defined reference frames. In the empirical investigation, I aim to determine the proportion of participants within the sample who align with each frame of reference. My second hypothesis asserts that different body positions do not change an individual's frame of reference. The third hypothesis predicts a relationship between the number of years spent learning Laban kinetography and the reference frame used by individuals.

2. THEORETICAL BACKGROUND

Research on spatial orientation can be divided into several sub-areas. In their study, Janellen Huttenlocher and Stella F. Lourenco (2007) summarise the literature on orientation in the wider environment. In broader geographical contexts (e.g. locating food sources or choosing areas to settle) or when judging the relationship between objects around an individual, spatial categories are utilised. Creating these spatial categories requires the ability to interpret symbols and words that describe spatiality. However, terms such as *above* or *next to*, for example, can sometimes complicate rather than clarify spatial orientation. The authors use the following example to illustrate this point:

> (...) in judging the spatial relationship between two cities in different states, the simple east-west relation usually supports the correct inference, for example that Las Vegas is east of San Diego. However, simplifying the category structure leads to errors, for example, Reno is also east of San Diego (Stevens & Coupe, 1978; Tversky, 1981, p. 21).

Vertical and horizontal lines are particularly important for spatial orientation. Among others, Appelle (1972) and Gentaz and Tschopp (2002) investigated the oblique effect, whereby vertical and horizontal orientations are more accurately perceived than oblique orientations. Coppola et al. (1998) also found that in both indoor and outdoor constructed and natural environments, vertical and horizontal lines are given greater weight in the perception of space than oblique lines. They suggest that this is due to the constant presence of the horizon on the ground surface and the perpendicular, vertical orientation of the vegetation cover, which counteracts gravity. This presumably evolutionary effect is not only found in everyday life, but also in art. Latto et al. (2000) investigated the aesthetic appeal of Mondrian's paintings as a function of their orientation. Participants preferred paintings with horizontal and vertical orientation to those with oblique orientation. This preference was not limited to the viewers; artists themselves also preferred vertical and horizontal lines in their compositions. Latto and Russell-Duff (2002) affirmed this conclusion in their analysis of 88 paintings by 20^{th}-century painters.

Another important area of spatial orientation research is the study of perception within the body. Sherrington (1907) distinguishes bodily perception (proprioception) from the systems responsible for the perception of stimuli from outside the organism (exteroception) and the internal state of the organism (interoception). In his interpretation, the proprioception system is responsible for determining the position and orientation of body parts and for mapping the relationship between the body and its environment.

Several studies have demonstrated the superior proprioceptive systems of dancers: Mouchnino et al. (1993) found that dancers perform 45° leg lifts with greater precision than non-dancers, and that both groups use the torso axis as a reference point for determining leg position.[2] Golomer and Dupui (2000) studied postural control in dancers and non-dancers, revealing that dancers were less dependent on their vision and used their proprioceptive system more than non-dancers to control their posture. Ramsay and Riddoch (2001) also confirmed enhanced proprioception in professional ballet dancers, who exhibited greater accuracy in determining upper limb position compared to the control group. Additionally, Jola et al. (2011) demonstrated that dancers outperform non-dancers in coordinated arm movements, suggesting that their body perception is not limited to local, single-joint proprioception, but is also present at higher levels of body representation.

In response to the problem detailed in the introduction regarding the complexities involved in the computation of direction, motion analysis has developed three well-defined systems of reference (Hutchinson, 1977; Szentpál, 1978; Knust, 1979):

1. In the standard directional reference, the forward direction coincides with the dancer's front, i.e. the front of the dancer's chest, while the up-down directions coincide with the line of gravity. Thus, this reference system turns with the dancer, but does not tilt with him. In other words, the forward direction is always coincident with the dancer's front, while the upward direction is always towards the sky, or, according to other reference points, the ceiling.
2. Constant directional reference is based on constant points in the space around the dancer, which never turn or tilt with the dancer. For example, in the case of the stage, regardless of the front or tilt of the dancer, the front always points towards the audience, the up always towards the ceiling.
3. In relation to the body axis, the directions follow the directional order of the body structure. This system turns and tilts with the dancer. Thus, in the case of a handstand, the top is directed towards the floor, the front remains coincident with the front.

3. SAMPLE AND INTERVENTION

For participant selection in the study, I chose readily available subjects through convenience sampling and the snowball method (Babbie, 2009). In selecting the experimental group, I aimed to cover a broad spectrum of ages, years of dance experience, and years of experience with Laban kinetography. Efforts were also made to achieve a balanced number of men and women in the study. To this end, I published a call for voluntary participation in the study among BA folk dance students at the Hungarian Dance University, as well as amateur adult and child folk dancers.

A total of 103 people applied for the study, which took place in the first half of 2022. The age distribution of the participants was as follows: 15% of the sample was aged between 5–14, 51% between 19–29, 11% between 30–39 and 23% between 40–61 years. The participants were nearly equally divided between women (53%) and men (47%).

[2] This method of computing orientation is used in the body-axis reference system of Laban kinetography.

Participants reported their years of dancing experience throughout their lives, encompassing their pre-school, school and post-school experience. Three groups can be distinguished in this respect. A small number of non-dancers were included in the sample and were grouped together with beginners and slightly more experienced dancers[3]. This least experienced group, representing dancers with zero to seven years of experience, accounted for 35% of the sample. Dancers with 10–19 years of experience comprised 44% of the sample, while those with more than 20 years of experience made up 21% (*Figure 1*). Regarding dance kinetography education, 38% of the participants had no experience with dance kinetography, 28% had studied dance kinetography for up to two years, while 35% had studied dance kinetography for three to eight years (*Figure 2*).

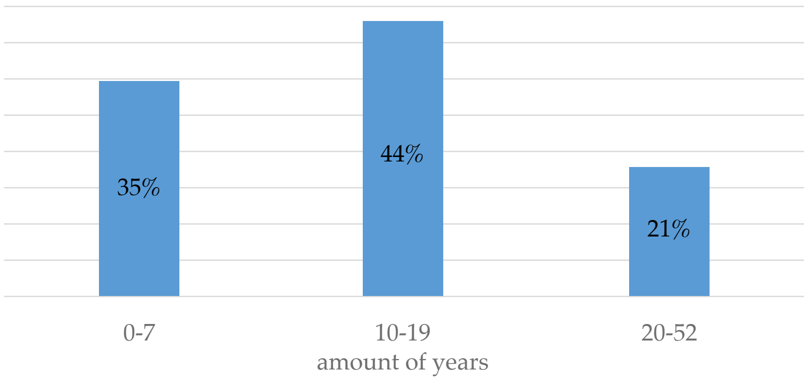

Figure 1. Distribution of study participants based on time spent dancing

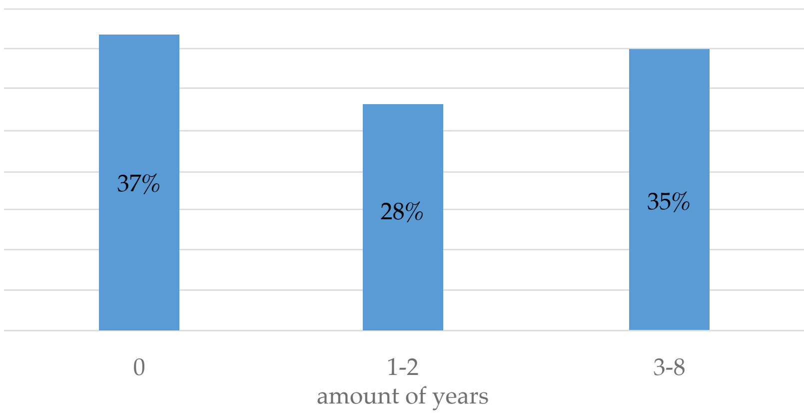

Figure 2. Distribution of study participants based on time spent learning Laban kinetography

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[3] In my experience, a minimum of ten years is required to achieve a high level of mastery in folk dance. The three main non-folk dancers in the sample had previously participated in sports or ballet. Based on the above and my familiarity the participants' abilities, I consider it appropriate to combine these participants into one category.

While organising the experiment and before recording, I informed the participants about their anonymity in the study and about the secure storage of the recordings on my computer. I video-recorded the participants' responses individually in the dance studio that they were familiar with. The dancers did not see each other while the experiment was being conducted, and in the case of minors, parents were present. After recording their names, ages, and years of experience in folk dance and Lábán kinetography, I asked them to complete the following tasks:

1. Raise your arms horizontally forward
2. Raise your arms in the air
3. Turn to the side, then raise your arms horizontally forward (Dancers were free to turn left or right and to decide how much to turn)
4. Raise your arms in the air
5. Sit down, then raise your arms horizontally forward
6. Raise your arms in the air
7. Lean back, then raise your arms horizontally forward (*Figures 6* and *7*)
8. Raise your arms in the air (*Figures 8* and *9*)
9. Lie down, then raise your arms horizontally forward (*Figures 11* and *12*)
10. Raise your arms in the air (*Figures 12* and *13*)
11. Sit up and lean back and at the same time raise your arms horizontally forward (*Figures 6* and *7*)
12. Sit up and lean back again, and at the same time raise your arms in the air (*Figures 8* and *9*)
13. Sit up and lie down and at the same time raise your arms horizontally forward (*Figures 11* and *12*)
14. Sit up and lie down, again, and at the same time raise your arms in the air (*Figures 12* and 13)
15. Face me and turn your chest, then raise your arms horizontally forward (Dancers were free to turn left or right and to decide how much to turn) (*Figures 17* and *18*)
16. Turn your chest and at the same time raise your arms horizontally forward! (Dancers were free to turn left or right and to decide how much to turn) (*Figures 17* and *18*)

To evaluate the first two hypotheses, I calculated the frequency distribution using univariate analysis on the data obtained from the assessment of the recordings. For the third hypothesis, I analysed two variables using a chi-square test, setting the significance threshold at $p < 0.05$ (Babbie, 2009).

4. RESULTS

In designing and wording the exercises, my aim was to make them clear and easy to understand. As the sample included children and amateur dancers, I avoided the use of overly technical terminology. The direction tasks utilised directions that appear in everyday movement, even if their interpretation is not conscious. With this in mind, and to ensure precise evaluation, the *forward middle* and the so-called *place high* directions were chosen, representing two non-adjacent main directions.

In this way, responses that deviated to a lesser or greater extent from the given directions could be defined. When analysing the kinematic responses, I measured the angles of the shoulder and the wrist relative to the straight spinal column with a margin of error between 5–10%. I also recorded instances where responses were uncertain or changed during execution. To ensure task comprehensibility, prior to the experiment I tested the exercises on a sample of ten amateur folk dancers. For the tasks involving turns, neither the laterality nor the degree of rotation was defined in order to be able to test different solutions by granting the performers a degree of freedom. For the task that asked participants' to lie back in a sitting position, the majority of participants leaned back at an angle of about 45 degrees, with only one participant laying down completely. For the task in which the subjects were asked to lie down, all of the participants lay on their backs rather than on their stomach or side, which would have complicated the evaluation process. Based on these observations, I retained the original wording of the tasks as they proved to be clear to the participants and in line with the purposes of the experiment.

The participants faced the camera for the first two tasks. In this position, all three reference systems produced the same result, resulting in a unanimous motion response from the participants. I transposed the responses onto the standard directional reference frame. In the first task (1. Raise your arms horizontally forward), all except one participant raised both arms to *forward middle* as defined by the standard. The exception was a child who had only been dancing for four weeks, who pointed *forward low*, a direction that does not correspond to *forward middle* in any of the reference frames and was therefore placed in the "other" category (*Figure 3*).

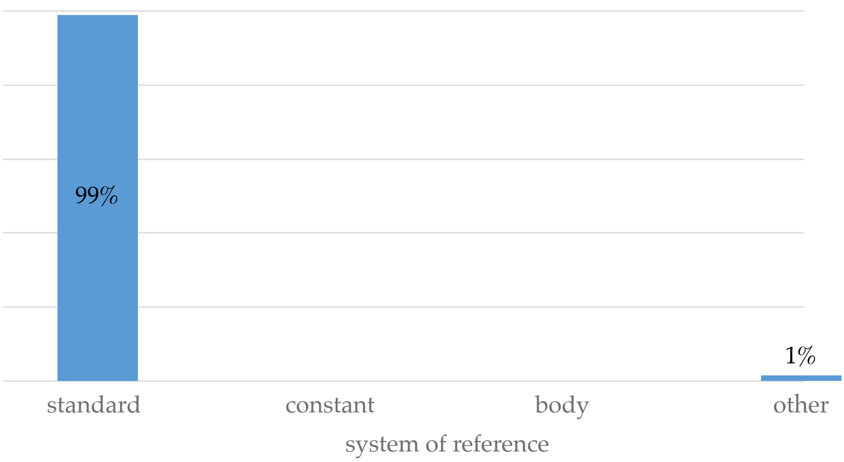

Figure 3. Distribution of responses for arms raised horizontally forward in the standing position

In the second task (Raise your arms up!), all participants uniformly raised their arms to the standard *place height* (*Figure 4).*

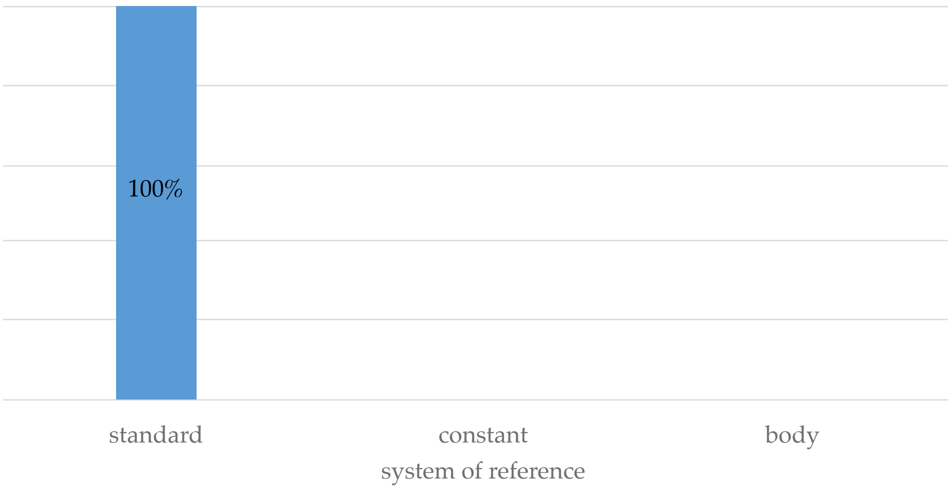

Figure 4. Distribution of responses for tasks 2–6

In the next exercise, when asked to turn sideways, all of the participants turned a quarter (90 degrees) to the right or left. Despite the fact that neither the direction nor the degree of rotation was specified in the exercise, all participants turned a quarter, suggesting the presence of an internal directional system utilised by all of the dancers. For the raise forward horizontally and raise both arms up tasks, 100% of the participants completed the task in line with the standard reference system (i.e., their forward direction pointed to their new front). The distribution of the results is shown in *Figure 4*.

In Exercises 5 (Sit down, then raise your arms forward horizontally) and 6 (Raise your arms up), participants raised their arms in the same direction as in the previous exercises, while maintaining a square front in a seated position. In both cases, the standard reference system was again used by 100% of the participants (Figure 4).

However, the reference system was no longer unanimous when the participants were asked to tilt their torsos backwards. The graph in *Figure 5* shows that when raising their arms forward, 69% of participants aligned with the standard reference system shown in the photograph in *Figure 6*[4], while 31% of the participants aligned their orientation relative to the body axis (*Figure 7*).

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[4] The photographs show the postures of Nóra Oláh, who did not participate in the study.

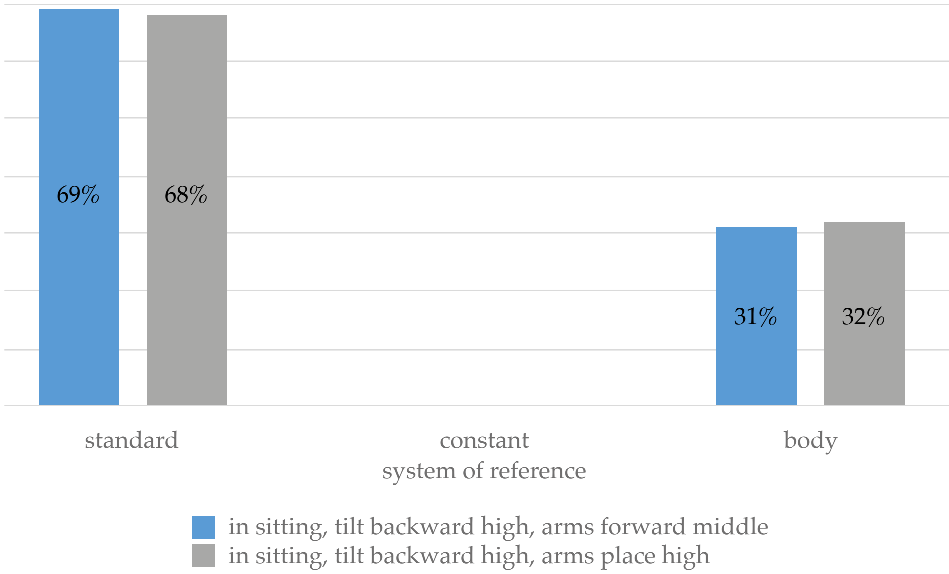

Figure 5. Distribution of solutions for arms raised *forward middle* and *place high* after tilting backward high

Figure 6. Forward middle arm position based on the standard system

Figure 7. Forward middle arm position in relation to the body axis

Similar proportions were observed for task in which arms were raised in an inclined position. Here, 68% of the participants adhered to the standard reference system, while 32% aligned with the body axis (*Figures 5* and *8–9*).

Figure 8. Place high arm position based on the standard system

Figure 9. Arms at *place height* (position in relation to the body axis)

In a lying position, the previously observed proportions were reversed. The diagram in *Figure 10* shows that for both arm positions, only one third of the participants determined the required directions based on the standard reference system defined by spatial lines at right angles to and coinciding with the line of gravity (*Figures 11* and *12*), while two thirds of the participants determined the directions in relation to the body axis (i.e. *forward middle* in *Figure 12* and *place high* in *Figure 13*).

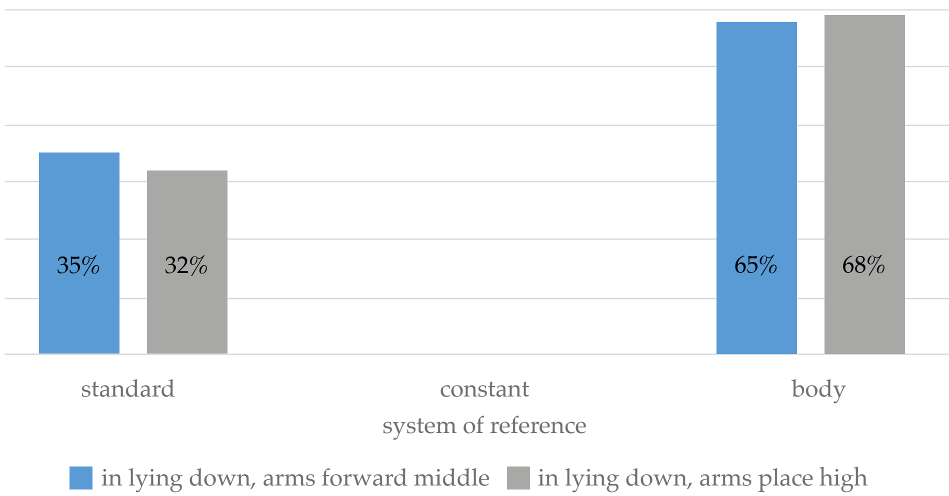

Figure 10. Distribution of solutions for arms raised *forward middle* and *place high* in the lying position

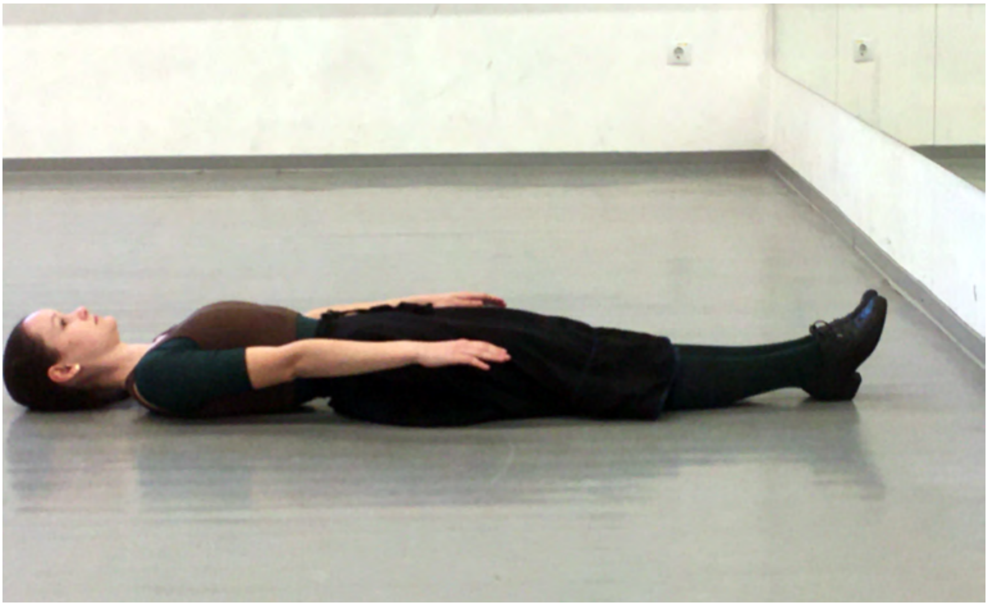

Figure 11. Forward middle arm position in the standard system

Figure 12. Forward middle arm position in relation to the body axis and *place high* arm position according to the standard system

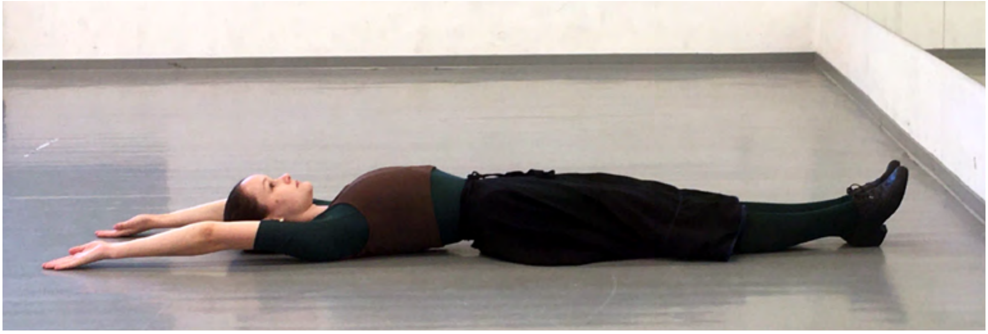

Figure 13. Elevated arms (position in relation to the body axis)

In the following exercises, the participants were asked to perform torso and arm movements simultaneously. The end result of the *forward middle* arm position, when performed at the same time as the tilted position, closely resembles the proportions observed in previous exercises in which the two movements were performed separately (*Figure 5*). Specifically, the distribution (*Figure 14*) between the standard reference system (*Figure 6*) and that of the body axis (*Figure 7*) was 63% to 37%, respectively.

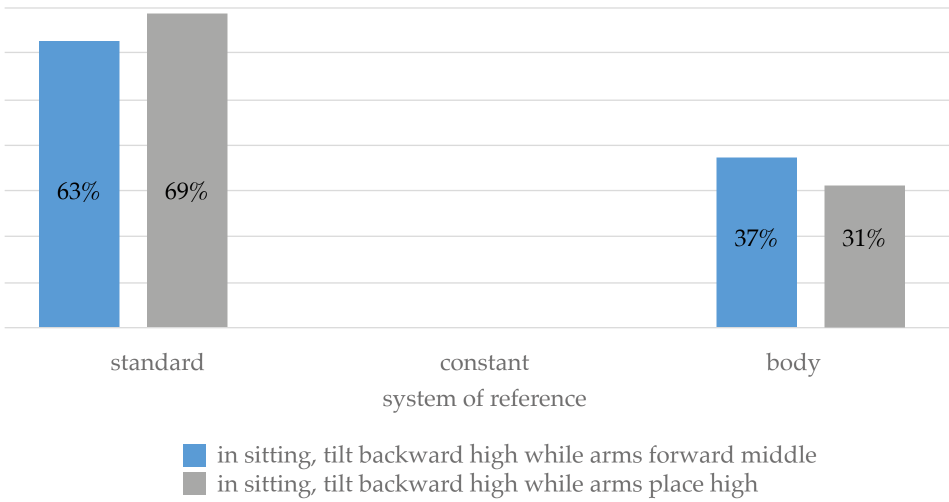

Figure 14. Distribution of responses for *forward middle* and *place high* arm positions with a backward high tilt

The distribution regarding the use of the two reference frames with arms raised to *place high* position with a simultaneous tilt is almost identical to that for the exercise with arms raised to the *forward middle* position while tilting (*Figure 14*). The proportion, 69% adhering to the standard reference frame (*Figure 8*) and 31% to the body axis (*Figure 9*), is also very similar to that measured in the exercises in which the two movements were performed separately (*Figure 5*).

For the arm positions executed in a supine position, the observed ratios remained consistent in both cases (*Figure 15*), closely aligning with those measured for the movements executed separately (*Figure 10*). Two-thirds of the participants used the body axis as a reference (*Figures 12* and *13*), while one third adhered to the standard system (*Figures 11* and *12*).

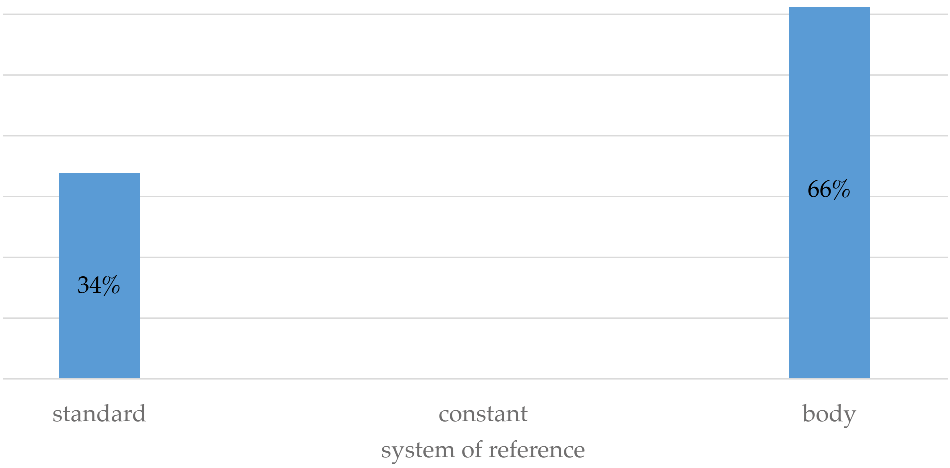

Figure 15. Distribution of responses for arms raised forward and raised up in a supine position

For the final task, participants faced the camera again and performed a torso rotation followed by raising the arms to a *forward middle* position. 87% of the respondents oriented themselves according to the standard reference system and 13% according to the constant direction system (*Figures 16–18*).

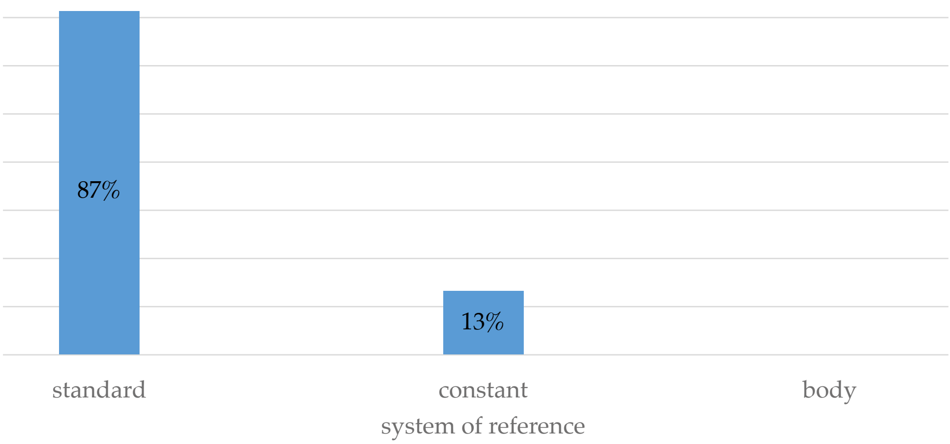

Figure 16. Distribution of responses to the forward raised arms exercise after trunk rotation in standing position

Figure 17. Forward middle arm position according to the standard system

Figure 18. Forward middle arm position according to the constant system

The results were similar to the arms raised forward position with simultaneous torso rotation (*Figure 19*). Here, the proportion of those using the constant direction system (*Figure 18*) increased slightly to 15%, while the vast majority (85%) continued to use the standard system (*Figure 17*).

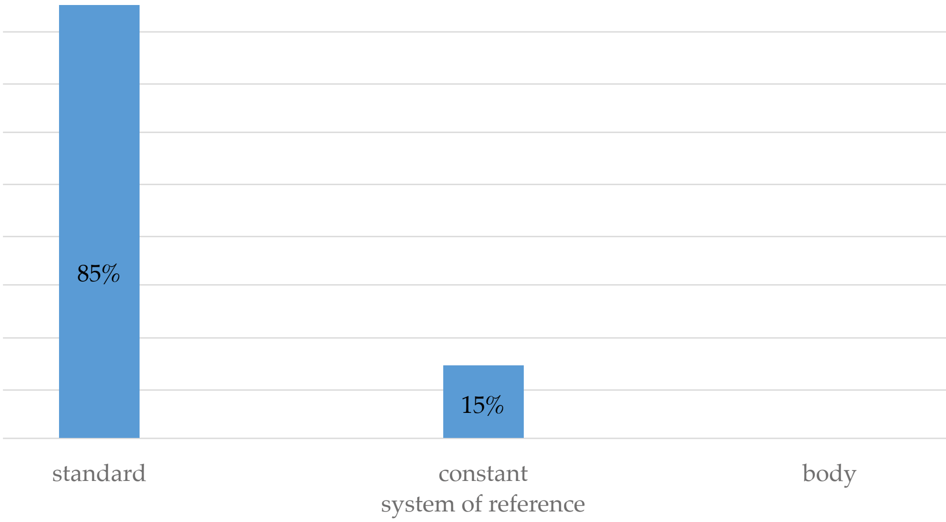

Figure 19. Distribution of responses to arms raised forward during trunk rotation in standing position

In the third hypothesis of this research, I hypothesized that the number of years spent learning Laban kinetography would influence the reference system used by the participants. In the first six tasks, there was no significant difference between those who had used and those who had not used Laban kinetography. However, differences in the use of reference systems became apparent when deviating from the vertical position, as indicated earlier. For exercises 7–16, only one exercise showed no significant differences between those with knowledge of Laban Kinetography and those without. In the case of the exercise with the trunk leaned back in the seated position followed by arms raised forward, the proportion of those who used the standard and body axis reference systems was 70–30% across groups with no, 1–2 years, and 3–8 years of experience with Laban kinetography. In contrast, for the other nine tasks there were larger disparities in the reference systems used when comparing those who were familiar and not familiar with the dance notation system, with minimal differences noted between the two groups who were familiar with Laban kinetography. For example, in the exercise that involved raising arms in the air while lying down, the proportion of those who had not learned Laban kinetography using two reference systems was half and half; meanwhile, for both groups with knowledge of Laban's system, the proportion of those using the body axis was three times higher than those using the standard system (*Figure 20*). The chi-squared test at $p < 0.05$ confirmed a correlation between the number of years learning Laban kinetography and the directional reference system used by the dancer. It should be noted that in Hungarian folk dance, positions that deviate significantly from the vertical axis of the body are very rare. As such, basic training in Lábán kinetography only briefly touches on this aspect. It is not until the third year of study that referencing using spatial directions is taught, with the whole body or a gesture moving in a specific spatial direction.

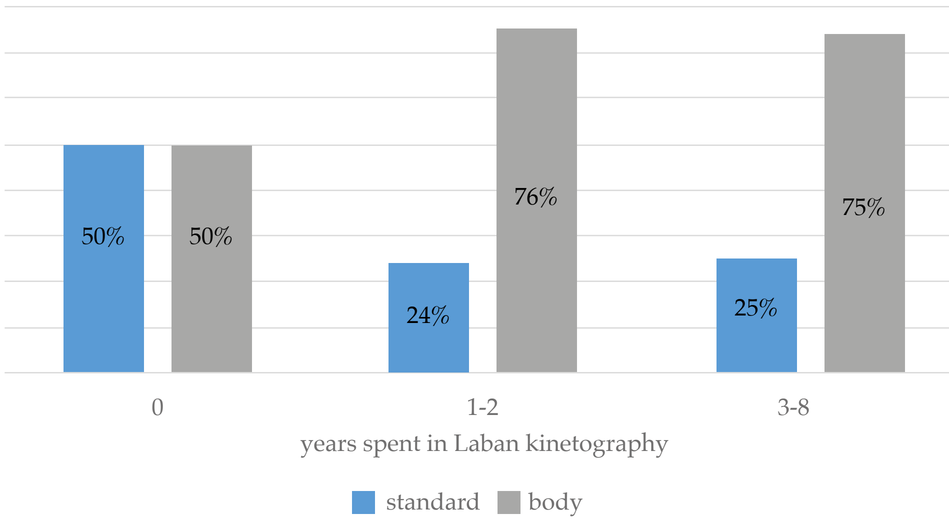

Figure 20. Distribution of responses to the arm raising task in a supine position comparing participants based on years of experience with Laban kinetography

5. CONCLUSION AND OUTLOOK

Based on the results of the present study, it is clear that the use of standard, constant, and body axis reference systems were all present in the population studied, thereby confirming the first hypothesis. The analysis affirmed that standard orientation was employed by almost 100% of the sample for the vertical posture exercises. Furthermore, it was evident that deviating from a vertical body position significantly altered the dancers' frames of reference. One-third of the participants used body axis orientation when leaning back compared to two-thirds when lying down. This means that the second hypothesis of the research, which posited that different body positions do not change the reference system used by the individual, has been disproven. Mouchnino et al. (1993) also noted the use of the body axis as a reference line in the case of leg gestures performed a standing position. The vast majority of the arm movements performed in a supine position were parallel or perpendicular to the ground (*Figures 11–16, 23–24*). This is in line with studies carried out by Appelle (1972), Gentaz and Tschopp (2002), and Coppola et al. (1998), who demonstrated the predominance of vertical and horizontal orientations over oblique lines. Further analysis is needed to determine which factors (e.g., gender, age, years of dancing experience, or years of experience with Laban kinetography) influences the use of different reference systems for different body positions within the sample examined in the present study. The third hypothesis of the research was partially confirmed. The analysis revealed that significant differences were found in the reference systems used by those who familiar with Laban kinetography and those who were not, particularly in the case of non-vertical body positions.

It would be worthwhile to extend this research beyond folk dance to include other dance disciplines and sports. Furthermore, it would be valuable to uncover whether an individual's system of directional reference changes over time. Notably, in several cases during the present research, I observed that the more the body's axis deviated from the vertical, the greater the proportion of uncertain or modified realisations during execution. This suggests that the same individual may perceive a different orientation system as primary during implementation. In addition to this, the present study can be conducted from a different perspective: rather than executing exercises based on textual instructions, participants could be presented with movements which they are then asked to translate into textual information.

The findings from this research offer thought-provoking implications for dance notation. The primary goal of the notator is to ensure that the recreation from the notation replicates the original in every respect. At the same time, the process of re-creation and the individual performing it are also extremely important. When documenting movements that deviate significantly from the vertical position of the body, it is important not to assume that the standard reference system will be used. Instead, providing a key for one of the axes could aid the recreator who is struggling between the learned rules of directional reference and their innate system of directional reference.

I would like to thank László Bernáth and János Kállai for drawing my attention to the relevant psychological literature that formed the basis of my research. I am also grateful to the participants of the study for their active contribution, and would like to thank Nóra Oláh for her professional and accurate depiction of the positions in the illustrative pictures above.

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