Continuous flux in flow of effort and shape

Underlying concepts developed by Rudolf Laban and Warren Lamb is an understanding of body movement as an ongoing continuous flux; "... shapes assumed by living organisms, wax and wane uninterruptedly... [an] uninterrupted flux" (Laban, 1966, pp. 3); "Everything is in a state of flux ... varying as the process of movement goes on" (Lamb, 1993, p. 7).

This article aims to highlight differences between conceptions of body movement as states, conditions or positions as opposed to concepts of change, motion or flux. This contrast will be considered relative to perception, awareness, motor control, movement memory, as well as Laban analysis. The intention is to raise awareness of the distinction between conditions versus flux, to raise questions related to distinction, and to encourage the explicit identification of which type of analysis is used in all areas of movement study and practice.

Cognitive Bias Toward Static Prototypes

While body movement may consist of continuous flux, human cognition manifests a tendency toward perceiving and remembering events and concepts as static prototypes.

Gestalt psychologists and cognitive research have revealed this as a process of abstraction whereby complex events are simplified and made as concise as possible during perception and memory, thus using less memory capacity and promoting quicker recall and shorter reaction times. This cognitive strategy brings ecological advantage to an organism, even at the risk of perceiving the world as over-simplified stereotypes.

Figure 1. A ladder of abstraction

A convenient way to visualise this process is with the "ladder of abstraction" (Hayakawa, 1972, pp. 176-198; Moore & Yamamoto, 1988, pp. 75-84) where cognitive processes can be seen as rungs of a ladder (Fig. 1). At the bottom of the ladder are raw sensory stimulations, pre-verbal, pure experience. Going up the ladder these raw bits are organised by grouping with other associated bits into clusters and higher-order categories. Further upward, the clusters are evaluated according to their significance within the immediate event, and higher up the ladder they are seen within ever larger contexts and circumstances. At the highest levels of the ladder are formulated generalised conclusions about broad patterns and tendencies or universal 'truths'.

A process of bias toward regular static prototypes can be seen within this abstraction ladder. While real-world stimulations at the bottom of the ladder may be chaotic, irregular and in flux, the abstraction process moving up the ladder sorts and categorises the sensations, forming mental representations which are more regular, simple, symmetrical and static than the original raw sensations actually were. A variety of effects associated with this process can be identified.

Geographical directions (in neighborhoods, cities, countries, make-believe maps) are remembered as more dimensionally aligned (north/south, east/west), and their intersections ('change of direction') as closer to regular right-angles, than they are in reality (Byrne, 1979; Lynch, 1960; Moar, 1978; Moar & Bower, 1983; Tversky, 1981).

Body positions oriented along a dimension are recalled most accurately while irregularly oriented positions tend to be recalled closer to regular sagittal or horizontal dimensions (Clark & Burgess, 1984; Wyke, 1965). Likewise, in travelling movements the angles of turning to a new directions are recalled closer to a right angles than they were in reality (Ross et. al., 1970).

The central primacy of regular, static, simplified prototypes may be explained in their use as "cognitive reference points" where irregular stimuli are not perceived or remembered independently but only "in relation to" regular prototypes. This is indicated by "linguistic hedges" where the irregular concepts are considered to be "essentially" or "almost" an almost identical regular concept, more often than a regular concept is considered to be "essentially" or "almost" an almost identical irregular concept (Rosch, 1975). Cognitive reference points are therefore used as perceptual / memory "heuristics" (rule of thumb) adopted to facilitate faster and economical cognition by categorising irregular stimuli as regular reference points which are simpler and more static than they actually were (Byrne, 1979; Tversky, 1981).

Heuristics reflect patterns of perceptual grouping identified by Gestalt psychologists with the organising principal "*pragnanz*" ('concise', 'terse') according to which perceptions and memories are organised into "regular", "simple", "stable" and therefore "good" patterns (Koffka, 1935, pp. 108-145; Wertheimer, 1923, pp. 79-83). For example, a brief views of acute or obtuse angles tend to be perceived as "pure" right angles (Wertheimer, 1923, p. 79).

Using simple, regular, static, and symmetric prototypes for heuristics and cognitive reference points appears to be a beneficial strategy as it increases memory capacity (by remembering a large number of items relative to a small number of reference points) and speeds up perception-reaction times (since recognition only requires a small number of reference points to be searched) thus bringing ecological advantage, even at the risk of perceptions and memories which may be over-simplified and stereotyped compared to actuality.

Continuous Flux and Steady States in Movement Study

Understanding cognitive bias toward prototypes gives a background for considering concepts of body movement as conditions, positions and steady states versus change, motion and continuous flux. Actual sensations and stimulations often correspond to continuous change while mental concepts are often regularized into more static conditions.

Sensory Feedback; Receptor Discharge

Anatomy of sensory receptors creates greater response to motions and less or no response to steady conditions. This occurs in "adaptation" when, after a period of steady-state stimulation sensory receptors adapt, thus switching to a lower level or absence of discharge. Greater sensory response only returns with new, changed movements. This is typical for muscle spindle receptors (Matthews, 1933; McCloskey, 1978, p. 770), receptors in tendons (Jansen & Rudjord, 1964) and in joints (Grigg, 1975; Skoglund, 1956).

Accordingly, the longer a body position is held, the less well that position can later be duplicated (Paillard & Brouchon, 1968; 1974), presumably because adapting receptors reduce their level of discharge after a brief time with no movement. Likewise, it can often be observed in education settings that learning new positions is often accompanied by frequent adjusting motions, presumably an attempt to gather increased sensory feedback (induced by motion) relating to that position.

Similarly in the vestibular system, endolymph fluid in semi-circular canals and otolith organs pushes against receptor hairs (creating sensory response) only when there is a change of motion (either change of speed or change of direction). In contrast during steady states of speed and direction, endolymph fluid stabilises within the organs, receptor hairs are no longer stimulated, and there is no sensory response (Howard, 1986).

Accordingly questions for education arise as to whether positions are learned better by experiencing the position itself, or by movements surrounding the position and whether sensory information for improving ability for balance is gained more from positions of balance or from motions off balance.

Habituation of Awareness

Similar to sensory adaptation, except at a higher level of perceptual systems, greater conscious awareness arises from changes of stimulation than to steady conditions. When external events maintain constancy perceptual systems become "habituated" whereby events and stimulations no longer enter into conscious awareness. For example constant smells, constant sounds or constant temperatures retreat out of consciousness and are no longer noticed. Awareness is often not reawakened until some change occurs in the stimulus array, such as a different smell or a habitual sound stopping. Habituation brings implications for all types of movement learning and communication as to what types of presentations induce awareness of the perceiver.

Position Memory

Memory for body position also relies on movement as evidenced by better recall of positions which have been learned by active movement rather than passively positioned (placed in position by an external manipulator) (Jones, 1972; Kelso, 1977; Marteniuk, 1973; Paillard & Brouchon, 1968; 1974; Roy & Williams, 1979). This may arise because of greater peripheral sensory feedback from active muscles (versus passive) and also because of "efference", a kind of central feedback giving information about motor commands for movements used to produce the position. This indicates that memory for a body position is not as much based on the position itself, but on movements associated with that position.

Motor Memory

Similarly, memory for body movements is shown not to be based on producing a series of positions but instead on the rhythm amongst a series of motions. Principles of "motor equivalence" and "equal simplicity" describe how body movements can be easily transformed by changing attributes such as size, location in space, orientation, speed, or body-parts used, without having to re-learn the movement. Because the external form or "trace" of the movements can be transformed in various ways, while the transformed movements can be performed with "equal simplicity" as the original, it is posited that the memory code for all the different movements is the same (Bernstein, 1984 [1935], pp. 106-117) and the different movements are considered to be "equivalent" with a motor representation that is "largely independent of the specific sets of muscles involved in the actual performance" (Morasso, 1983, pp. 208-209; also Saltzman, 1979, pp. 94, 103).

For example, spatial forms in handwriting movements retain their particular style even if performed with physical variations such as with the non-dominate hand, with the arm only (wrist immobilised), with the pen held in the teeth, or increased in size (Bernstein, 1984, p. 114; Merton, 1972, p. 32; Raibert, 1977; Schmidt, 1982, p. 305; Smyth & Wing, 1984, p. 12). "Shakiness" of the trajectory increases but the essential "style" of overall shapes and relative sizes of letters remains invariant. Similarly, a common example occurs in ballet classes when students rehearse movements of the feet by 'marking' or practising these movements with the hands.

When a movement is transformed, usually all of the positions in that movement are changed because the movement is smaller or larger, or moved to a new place, slightly deformed from changes in speed, or produced with different body parts. The essential memory code or "basic pattern" is defined as being the pattern which remains consistent throughout all the variations. This has been shown to be the rhythm (proportional timing) amongst the series of muscular impulses for each consecutive motion (Schmidt, 1975, p. 235). This became the dominant theory describing the rhythmic basis of motor programs and referred to as "phasing" (Keele & Summers, 1976; Schmidt, 1976; Shapiro & Schmidt, 1982, pp. 133-136; Wing, 1978, 1980). Hence, motor memory and motor control appear to be based on timing amongst motions, rather than positions or body parts used.

Biomechanics

Mechanical analysis of bodily forces is also based on motions. Analyses of forces within a body position can identify some information (potential energy contained in the position, tensile force required to maintain the position), however even in static cases there appear dynamic forces (muscular adjustments and re-initiations of small motions) which attempt to keep a position stable. In other words, static shapes do not exist and all equilibrium positions are maintained by continuously adjusting motions.
Therefore, biomechanics focuses on analyses of motions and resultant forces which are measured as vectors (direction & distance) and speed of the body's center of gravity and centers of gravity of individual limbs or body segments. Analyses are represented in "free body diagrams" with arrows to represent the magnitude and direction of forces relative to centers of gravity (Fig. 2). Understanding physical requirements involved in any body pattern relies on analyses of motions and associated forces with positions considered as moments within the overall movement stream.

cg = Center of gravity of entire body
cgRTA= Center of gravity of right arm (same as **cgLftA,cgLftL)**
W = Weight
∑F = Net Force exerted by kinetic chain
R = Ground Reaction Force
Rv = Vertical component of R
Rh = Horizontal component of R (friction)
H = Angular momentum
HcgRTA = Angular momentum of Right Arm relative to cg of entire body (same as **HcgLftA, HcgLftL**

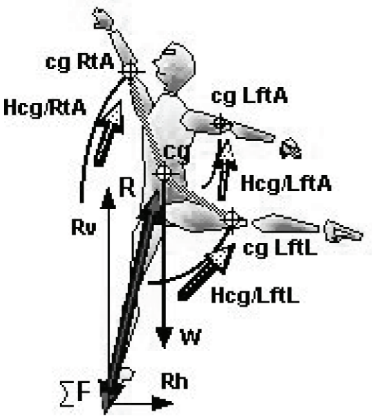


Figure 2. Motions and Forces in Biomechanical Analysis
(derived from McGinnis, 1999, p. 180; Watkins, 1983, p. 57)

NonverbalCommunication

The contrast between positions versus motions occurs in analyses of nonverbal communication as analysis of meaning in states (positions, eg. folded arms, crossed legs, puffed up chest) and also as changes (motions, eg. folding / unfolding, crossing / uncrossing, expanding / condensing). To highlight the contrast, one example is given here from non-verbal expert Kate Jobe (2007) regarding a description of walking along busy streets in large cities with a common experience of people bumping into you because of the crowds. Personal experiments revealed that by "getting wider" when someone approaches (on a potential collision course) that the person will respond to this nonverbal signal and deviate to avoid collision. However just "being wide" will not produce the same effect and people will not deviate, instead "you have to do the motion" which creates the nonverbal signal that is received and responded to.

This example puts emphasis on the role of motion in nonverbal communication. Similar to sensory response and habituation, a steady state ("being wide") receives little or no response, the static condition is not noticed, whereas motion ("getting wider") creates a change in stimulation, a signal that is registered and reacted to by the perceiver.

Flow Lines; Notation of Flux

In order to look in detail at aspects of fluctuation changes versus steady states, it is useful to draw on a form of notation sometimes known as "flow lines" (Sossin & Kestenberg Amighi, 1999, p. 13). These probably provide the best visual depiction of patterns of flux and are used to represent continuous variation of some attribute through time (eg. muscle tension, movement speed, size of reach space). Generally, as the flow line goes up, the intensity or magnitude of the attribute increases, when the flow line goes down, the intensity or magnitude decreases (Fig. 3).

Figure 3. Prototype flow line diagram.

Flow lines are often used in Laban analysis and also in many other areas of study. They are common in all types of physics studies to represent wave fluctuations (eg. frequency of sound waves or electromagnetic waves) and in body movement study are typical of EMG recordings of muscular activation. Similarly, they can also be drawn by hand (from visual observations) for example as "neuromuscular excitation patterns" (Fitt, 1979, p. 164) where fluctuating patterns of activity in agonist and antagonist muscles reveal particular characters or qualities (Fig 4). Flow lines can also be used to represent flux of spatial attributes, for example the continuous flux of spatial levels from lying to jumping in Doris Humphrey's *Water Study* (Rodiger, 1983, p. 28). Attributes of energy and space can also be combined in flow lines, for example to represent degrees of pressure exerted in particular directions with each pattern being correlated to particular emotional states in studies of "sentics" (Clynes, 1973, p. 66; Clynes & Nettheim, 1982, p. 55).

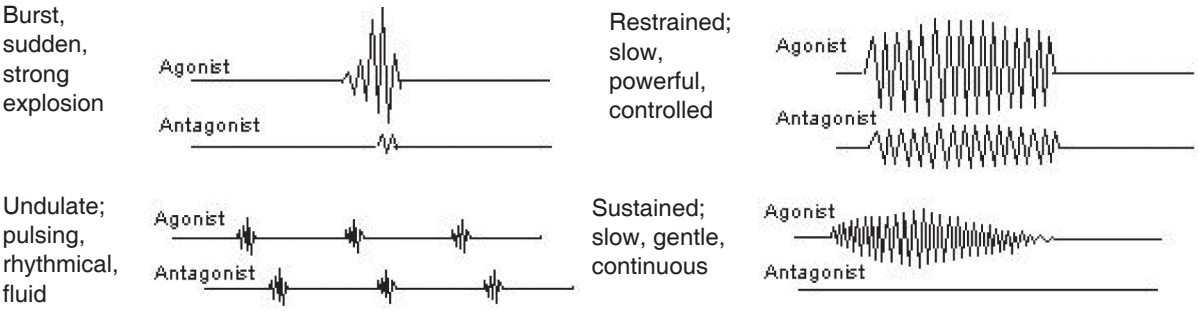


Figure 4. Flow lines representing neuromuscular excitation patterns (Fitt, 1979, p. 164).

Shape Flow, Effort Flow

In Laban analyses flow lines have especially been used in methods developed by Lamb and Kestenberg where a distinction is made between flux in effort dynamics and flux in shape change (Fig. 5). Effort flow refers to tension or rhythm fluctuations between freeing and binding while shape flow refers to form or direction fluctuations between growing and shrinking (Merman, 1990, p. 86; Lamb & Watson, 1979, p. 51, Lamb & Turner, 1969, p. 58; Loman, 1990, p. 55).

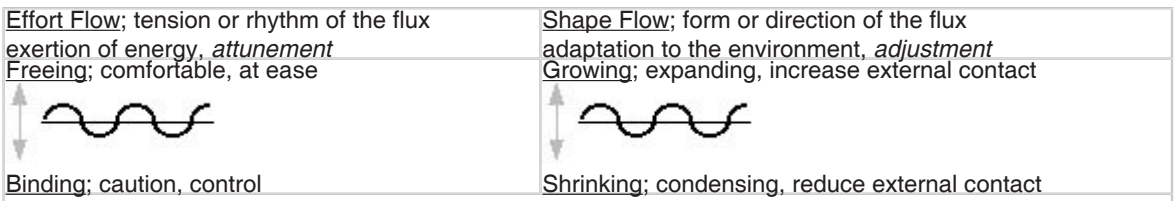


Figure 5. Distinction between Effort Flow and Shape Flow

Effort Flow Differentiation

Effort flow is further differentiated into characteristic rhythms of freeing and binding, sometimes known as “Kestenberg rhythms”, represented with flow lines and developmentally associated with Laban efforts (Kestenberg, 1967, p. 45; Lewis, 1975, pp. 64-65; Lewis, 1986, p. 172; Sossin & Kestenberg Amighi, 1999, pp. 1–20, 27-55). The utility of expressing these with flow lines is that each rhythm can be literally ‘read’ from the increase / decrease progression of the line (Fig. 6).

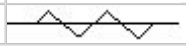
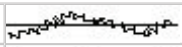
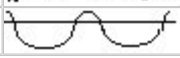
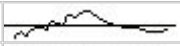
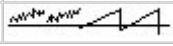
Tension-flow Rhythms (id)		Tension-flow Attributes	Effort precursors (pre-efforts)	Efforts (ego)
ORAL			Space (focus)	
sucking, swaying		flow adjustment	flexibility	indirect
biting, clapping		even flow	channelling	direct
ANAL			weight (force)	
twisting, squirming		low intensity	gentleness	light
strain then release		high intensity	straining	strong
URETHRAL			time (timing)	
drifting, wandering		gradual flow	hesitation	sustained
streaming then stopping		abrupt flow	sudden	quick

Figure 6. Tension-flow-Effort system (developmental); flow lines showing rhythms of tension.

Effort Flow / Shape Flow Correlation

Flow lines are also used to show correlations of effort and shape fluctuations in case studies. By ‘reading’ the flow lines it is possible to get a sense of the types and ranges of intensity of the movements which are used by this particular person (Fig. 7).

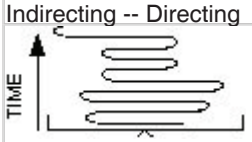
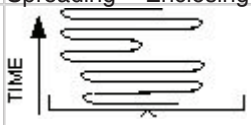
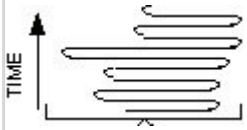
EFFORT FLOW	SHAPE FLOW
 Indirecting -- Directing	 Spreading -- Enclosing
 Decreasing - Increasing pressure	 Rising -- Descending
 Decelerating -- Accelerating	 Advancing -- Retiring

Figure 7. Correlating effort flow and shape flow (adapted from Lamb & Watson, 1979, p. 83).

Issues of States versus Flux in Laban Analyses

Issues of states versus flux run throughout Laban analysis and Laban notation. Rudolf Laban and Warren Lamb have both commented on the ever-present tendency to perceive and categorise events as static conditions rather than continuous change:

> “This illusion of a standstill is based on the snapshot-like perception of the mind which is able to receive only a single phase of the uninterrupted flux.” (Laban, 1966, pp. 3)

> “If we confuse nonverbal behavior observations based on fixed images with observations of movement, without making the distinction clear, we do a disservice” ... “It is always easier to look at the fixed position and fool ourselves that we are looking at movement.” (Lamb, 1993, p. 8)

Example effort sequence	
Likely reading (increase / decrease signs)	
Explicit representation of flux (flow line)	

Figure 8. Flux implicit in effort to reinitiate consecutive conditions.

Effort,Dynamics

Effort concepts such as light, strong, quick, sustained, bound, free, direct, indirect, float, punch, glide, slash, dab, wring, flick and press tend to indicate qualitative status or conditions. In addition, effort modifiers such as plus (+) or minus (-) also tend toward seeing the concepts as a status or condition of magnitude or intensity.

Similar effort concepts described as accelerating, decelerating, increasing or decreasing pressure, freeing, binding, or the act of "becoming" tend to indicate a character of flux or modulation. Sometimes fluctuations are made more explicit by highlighting continuous changes amongst efforts such as "Effort used in actions and that used in recovery serve and help each other in alternating with one another in a definite rhythm." (Laban, 1971) or that movement "decelerates in order to accelerate, and vice versa" (Lamb, 1993). In these descriptions contrasting efforts are not seen as opposing conditions, but in a single process of fluctuation.

In effort notation a single effort sign is usually interpreted as indicating a condition or degree of intensity. This conception of effort as a status is reinforced by including the plus (+) or minus (-), giving further details as to which condition is indicated. When several effort signs are written in sequence, this is usually read as changes, but these are changes from one condition to another (thus, each effort sign still indicating a status to be achieved, rather than change itself).

However, in some cases, such as when the same effort sign is written several times in a sequence, there is revealed an implied flux within the effort system. This flux can be made explicit by notating the same sequence using increase (<) and decrease (>) signs or with a flow line. As shown in the notation (Fig. 8), the most likely reading of the same effort sign repeated in a sequence is to include a modulation or flux toward and away from the state defined by the sign. The effort sign itself still represents a specific condition or status, however the aspect of flux reveals itself as an implicit function of effort, giving modulations in order to continuously reinitiate each consecutive status.

Shape, Shaping

While some concepts of 'shape' tend to indicate static conditions (eg. concave, convex, pin, wall, ball, screw) the majority of shape concepts indicate processes of change (eg. growing, shrinking, widening, narrowing, lengthening, shortening, bulging, hollowing, spreading, enclosing, ascending, descending, advancing, retreating) and this concept of ongoing shape fluctuations is reinforced by defining shaping actions as those which "accommodate to the plastic character of objects ... to mold space into plastic forms" (Dell, 1970).

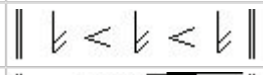
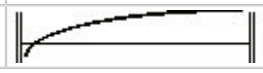
Example shape sequence	
Likely reading (as motion) (increase / decrease signs)	
Explicit representation of flux (flow line)	

Figure 9. Shape sequence as continuous increase

Example shape sequence	
Likely reading (as motion) (increase / decrease signs)	
Explicit representation of flux (flow line)	

Figure 10. Shape sequence with fluctuations.

Accordingly, when a single shape sign is written it is likely to be read as a constant process of change (rather than a state to be achieved as in effort notation). Likewise, if a single shape sign is written several times in a sequence, the likely reading will be a continuous increase in that shape quality. This process of change can be made explicit by using increase (<) and decrease (>) signs or with a flow line (Fig. 9).

Right arm position: right-forward-high Left arm position: left-backward-middle Left leg position: backward-middle	

Figure 11. Space notation with Labanotation direction signs indicating locations or points.

Right arm motion: upward-right-backward ('steep' vertical deflection) Left arm motion: upward-left-backward) ('flat' lateral deflection) Left leg motion: upward-left-backward ('suspended' sagittal deflection)	

Figure 12. Space as motion of limb centers of gravity.

If modulating fluctuations are desired, then contrasting shape signs need to be written showing opposite directions of shaping, or this might be indicated with decrease signs, or shown with a modulating flow line (Fig. 10).

Space, Choreutics, Directions

A predominance of space concepts tend toward representing space as static conditions (eg. locations, points, high, deep, left, right, back, vertical, horizontal, sagittal, dimension, plane). While there is also another tradition of concepts which conceptualise space as processes of change (eg. upward, downward, sideward, forward, backward, deflection) and this view of space as motion is reinforced with descriptions such as "the path consists of an infinite number of appearances and disappearances, which we called the flux of time" and "certain natural standard scales, at first described as going from point to point, are in reality built up from rays or inclinations" (Laban, 1966, pp. 28, 132).

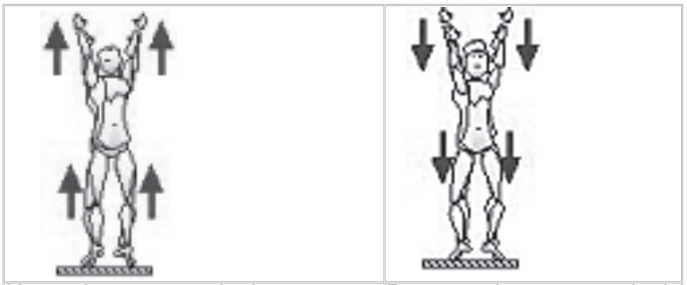
The dominate type of space notation using Labanotation direction signs represents space as positions or points to be achieved, with motion implied as the transition from one location to the next (Fig. 11).

A different notation representing space as motion was experimented with during the early development of Labanotation (Laban, 1926; Longstaff, 2005) but was not included in the first publication of kinetography in 1928, which was a "painful compromise" since "Laban wanted at all costs to defend that he was writing motion, not positions" (Preston-Dunlop, 1998, pp. 131-132). Laban returned to a modification of the concept in the 1930s, describing "free space lines" as "an old dream" left for the "future development of kinetography" (Laban, 1966, pp. 125-130). A similar concept (but without deflecting directions) was also devised as "direction of the progression" (Hutchinson-Guest, 1983, p. 261).

The early space 'vector' signs indicate direction of motion, or orientation of a pathway, without stating the beginning or end position, thus representing space as continuous flux (Fig. 12).

Affinities

A unique aspect of Laban analysis are the combinations of effort and space (or effort and shape) which are "more naturally performed" (Laban, 1963, pp. 38-39) or "most easily take place" together (North, 1972, p. 260) and so are considered to be "affinities" (Lamb, 1965, p. 63). When considering concepts of body movement as either motions or conditions, the obvious question emerges as to whether affinities relate to motions (change, flux) or to conditions (positions, states).

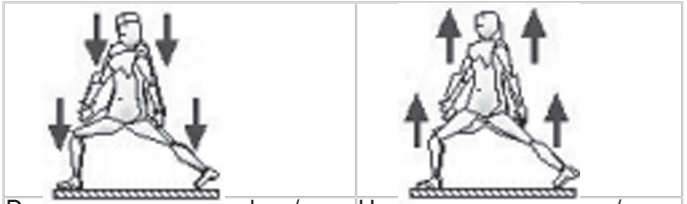


Upward motion in a high zone | Downward motion in a high zone

Figure 13. A high zone with either upward or downward motion.

For example, is lightness an affinity with motion rising upwards or with the condition of being high? Is strong effort an affinity with motion descending downward or with the condition of being deep?

Moving upwards and being high do not always occur together (Fig. 13). If there is downwards motion entirely within a high zone, is the most easily performed effort (affinity) strength or lightness? Likewise, downwards movement and being low do not always go together (Fig. 14). If there is upwards movement within a low / deep zone, is the most easily performed effort (affinity) strength or lightness?



Downward motion in a low / deep zone | Upward motion in a low / deep zone

Figure 14. A low / deep zone with either upward or downward motion.

Conclusion

The intention here is not to give answers, but to highlight contrasts between considering body movement as conditions or motions and to identify questions arising from this contrast. Both of these types of analyses are used in many areas of body movement study. While motion plays crucial roles in many areas of body perception, awareness and memory, the service of cognitive economy seems to favor mental representations as static states. Particular contrasts of motion versus flux can be seen in areas of Laban analyses.

This issue became important to me initially out of my dissatisfaction with practice of choreutics based on "reaching to the points". No matter how much emphasis is placed on involving the entire body, this conception always seems to create movement with distal tracing of external forms. Related to this was my dissatisfaction with particular locations of the "points" and my observation that spontaneous, organic body movement often does not conform to these particular locations. Human body movement is much more variable than the five regular polyhedra.

Quite accidentally I stumbled upon Laban's early system in Choreographie (1926), translated the notation (called them "vector signs" as Laban gave them no name) (Longstaff, 2001a, 2001b), and realized that these signs (which pre-dated kinetography, choreutics, and effort) offered a conception based on deflecting motions rather than positions. As I experimented with the signs I was surprised that choreutic forms started to become more obvious and actually simpler since the requirement to conform to the externally imposed rigid scaffolding was removed.

My enthusiasm for Laban's early motion signs was further encouraged after I reviewed how Laban's reaction to their exclusion from kinetography in 1928 was for him a "painful compromise" and how later he referred back to these concepts as an "old dream". Eighty years later I have heard Laban's dream when the meaning of these signs had been completely lost and their concept of motions as "deflections" has mostly become an obscure side-note of choreutics, rather than the fundamental concept upon which the entire system is built.

Finally, I have come to realize how the issue of motions versus positions spreads to many other fields. The vector signs themselves are virtually identical to biomechanical analysis (compare figures 2 & 12 above) providing a correspondence between choreutics and scientific fields. The issue reaches even farther into human social perceptions of personality, culture, race, age, etc. Just like positions and motions, it is always easier to perceive events and people according to static categories and stereotypes, while the reality is that everything and everyone is in a continuous process of change. As the body and mind are connected, my experience that understanding continuous flux in the body corresponds to also understanding flux in human society.

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