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Links between Metamotivational State, Arousal, and Effective Japanese Archery (Kyudo) Performance: An Exploratory Study

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Japanese archers (N=9) of different ability levels each shot a total of 12 arrows in 4 separate trials. The Telic State Measure administered pre and post each trial, provided information about subjects' mental state. Aspects of Japanese archery performance were measured by (a) strain gauges fixed to the bow and (b) a short questionnaire used immediately after each shot to provide information about which aspects of shooting technique subjects were conscious of at different stages of shooting. Data were analyzed using correlational analysis techniques.The results indicated a number of significant correlations between TSM scores (including serious-playful, planning-spontaneous, felt arousal, preferred arousal, arousal discrepancy and effort) and aspects of effective Japanese archery technique (including arrow length during the draw (Nobiai), the force exerted by the string hand, the force exerted by outwardly rotating the bow hand, and the percentage of successful target hits). These results suggest that generally being in the telic state was beneficial to successful Japanese archery performance. Arousal item results were less clear, suggesting that higher levels of felt arousal were beneficial to some aspects of performance, but detrimental to others. The authors argue that, based on the present study, future research with larger groups balanced for ability is warranted.

Key words: Kyudo, Japanese archery, metamotivational state, arousal, reversal theory

Japanese archery (Kyudo), a martial art based on the traditional Japanese code of chivalry (Budo), is known throughout the world and is popular as a sport in Europe. In Japanese archery, the state of mind of the archer and the unity between the archer's mind, body and bow are considered crucial to effective performance. Throughout its history Japanese archery has been strongly influenced by Zen Buddhism (e.g., Herrigel, 1953[5]), in which mental training, breathing and arousal control in developing a sense of calmness are important parts of the so-called 'experience of enlightenment' (satori). Japanese archery's unique qualities, in terms of the unity between mind, body and skilled performance, make it a very interesting activity for research study.

Psychologists have been interested in studying the effects of different mental states on sport performance and have engaged in research across a wide variety of sports (e.g., Cohn, 1991[2]; Heishman & Bunker, 1989[4]; Males & Kerr, 1996[10]). However, English language literature searches indicate that, although a few studies of 'western' archery have been undertaken (e.g., Landers, et al., 1994[9]; van der Mars, Darst, & Sariscsany, 1991[13]), almost no published studies have investigated psychological aspects of Japanese archery performance. One exception was a study conducted by Miyamoto (1994[11]) who examined changes in heart rate and somatic anxiety during Japanese archery practices and matches. Some differences were found in archers' (N=5) somatic anxiety and heart rate scores between practice and match situations, but the data were considered insufficient for definite conclusions to be drawn.

Reversal theory (Apter[1], 1982; Kerr, 1997[8])

is a relatively new psychological theory which emphasises the importance of hedonic tone (experienced pleasure) and changing levels of arousal in motivational experience and the individual's interpretation of that experience within particular mental states. As arousal may play an important role in Japanese archery performance, and the fact that reversal theory had been used successfully in previous sport research (Kerr, 1997[8]), it was thought that it was an appropriate theoretical basis for the present study.

A brief explanation of reversal theory

Reversal theory is a phenomenological theory and, thus, the subjective experience of the person plays an important role. Behaviour is thought to be directed by the manner in which a person interprets and structures his or her own motivation. Human behaviour is thought to be fundamentally inconsistent and, consequently, the motives causing an person to act in a particular way may be very different on different occasions. The origin of these motives can be found in four pairs of metamotivational states known as the telic-paratelic, negativistic-conformist, mastery-sympathy and autic-alloic states. These pairs of metamotivational states are thought to exist together as alternative stable states within a bistable system. People are thought to alternate between the two paired states.

The notion of alternating or reversing between paired metamotivational states is the basis of reversal theory's approach to human motivation. According to reversal theory, there are three sets of conditions under which reversals are likely to be induced. First, the occurrence of a contingent event may act as an inducing agent to trigger a reversal from one state to the other. Second, under conditions of frustration (e.g., where the needs of the person in the telic state are not being met) a reversal is likely to take place. Third, under conditions of satiation where, the longer an person has remained in a metamotivational state, the greater the likelihood that a reversal to another state will occur.

Some forms of behaviour are more likely to be undertaken with one particular metamotivational state operative, but it must not be assumed that one particular act is, for example, always telic (or paratelic). Reversal theory emphasises the importance of the person's subjective experience and consequently activities which, for one person, are generally carried out in, for example, a telic state of mind may, for another, be undertaken with the paratelic state operative. In addition, it is entirely conceivable that the same person, engaging in similar activities on different occasions could be in different metamotivational states.

The concern in this study is with the particular relationship between telic and paratelic metamotivational states as behaviour in these states is directly linked to a person's experience of felt arousal. When a person is in the telic state his or her behaviour is likely to be serious, planned and goal-oriented, whereas in the paratelic state, a person's behaviour has a spontaneous and impulsive, nongoal-oriented character. Felt arousal is the degree to which a person feels him or herself to be "worked up" at a given time. Low levels of felt arousal are generally preferred in the telic state, while the person in the paratelic state prefers and often actively seeks high levels of felt arousal. As shown in Fig. 1, this means that, depending which metamotivational state the person is in at a certain time, hedonic tone (experienced pleasure) and related emotional feelings are closely linked to level of felt arousal.

As can be seen from the X curve in Fig. 1, high arousal in the paratelic state is experienced as pleasant excitement and low arousal in the telic state is experienced as pleasant relaxation. Conversely, high arousal in the telic state and low arousal in the paratelic state are experienced as the unpleasant emotions, boredom and anxiety respectively.

A reversal theory-based state scale, the Telic State Measure (TSM; see e.g. Svebak & Murgatroyd, 1985[12]), concerned with the telic-paratelic

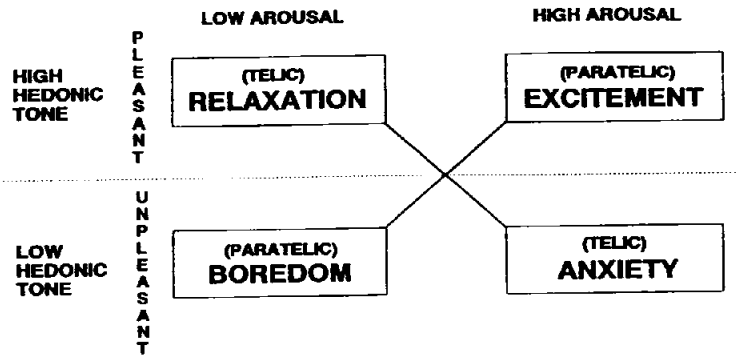

Fig. 1 The different ways of experiencing felt arousal in the telic and paratelic states (Kerr, 1994).

pair of metamotivational states was used to provide information about the archers' mental state (see Measures and Procedures section).

Japanese archery technique is complex and requires the performer's complete attention to be successful (e.g., Heath, 1972[3], pp. 215-245; Inagaki, 1981[7]). When an archer draws a Japanese bow, several interrelated movements must be carried out at the same time. The three most important movements are: (1) an almost undetectable gradual and continuous outward twist of the left hand (Yunde) gripping the bow and, on release, the exertion of a momentary but greater outward twist, thus exerting greater force to the right inner side of the bow (Tsunomi-no-hataraki). This movement is necessary to shoot the arrow swiftly and straight with good penetration; (2) a gradual inward twist of the right forearm to provide more force (Katte-no hineri). This movement helps with effective execution of the first movement; (3) the drawing back motion of the arrow and bow string using a steady ('long') draw of about 1 mm per second to a pre-determined length. A full-length draw with 'good arrow length' is desirable for effective shooting (decided on the basis of 'arm length' - Yajaku) with the shaft of the arrow in contact with the right cheek continuously until release (Nobiai). The effective performance of the third movement also includes the other two movements, the outward twisting motion of the bow hand and the inward twist of the string hand (Mete) in the draw.

The purpose of this study is an exploratory examination of the possible links between the telic or paratelic metamotivational state, and/or felt arousal level, and effective Japanese archery performance.

METHOD

Subjects

Volunteer subjects in this study were Japanese archers (N=9) average age 25.8 yrs., range 18.5 - 44 yrs. of different levels of ability.

Measures and Procedure

The Telic State Measure (TSM; see e.g., Svebak & Murgatroyd, 1985[12]) was used to provide information about the subjects' mental state. The TSM has five response items: *serious-playful, planning-spontaneous, felt arousal, preferred arousal* and, a later addition, *effort*. Subjects were asked to respond to each item on a six-point rating scale. A sixth item, *arousal discrepancy*, is obtained by subtracting the respondent's score on item 3 (felt arousal), from the respondent's score on item 4 (preferred arousal).

A series of additional questions in a short questionnaire were used to provide information about which aspects of shooting technique subjects were conscious of (e.g., continuous outward twist of the bow hand) at different stages of shooting (preparation, during drawing, 'arrow against cheek', moment before release, hit or miss), and how successful they thought they had been in attending to these aspects of technique. Subjects' 'strength of draw' during shooting was

measured by strain gauges fixed to the bow (see Method section; also, Hirose, 1996[6]).

Each subject shot a total of 12 arrows in 4 separate trials in which the number of target hits was recorded. Scoring in Japanese archery is straightforward and consists of either hitting or missing the target. Unlike other forms of archery which have concentric rings on the target, in Japanese archery the actual place where the arrow hits the target is not used in scoring.

As each subject shot an arrow, electrical signals from the strain gauges fixed to the bow were recorded and the archer's action captured on videotape. The force of the bow hand was directly determined by strain gauge readouts. The force of the string hand was calculated from the forces involved in bending the bow and the twisting action of the string hand. There was a linear relationship between force and the value indicated on the strain gauge.

Following each shot, subjects completed the questionnaire about attention to aspects of shooting technique, and the TSM was administered to subjects pre and post each of the four archery trials. Data were collapsed across trials and analyzed by correlational analysis techniques. In each case, the degrees of freedom should have been $9\times4-2=34$, but due to a few missing values the degrees of freedom were 30.

Given that Japanese archery training emphasises calmness and the control of breathing and arousal, and reversal theory's explanation of the experience of arousal in the telic and paratelic states, pre-experimental expectations were that Japanese archery performance would be more successful when archers were (a) in the telic state and (b) experiencing low levels of arousal.

RESULTS

Metamotivational state results

Pre-trial, TSM *serious-playful* ($r=-.436$, $p=.01$) and TSM *planning-spontaneous* ($r=-.618$, $p=.0002$) scores were found to correlate significantly and negatively with arrow length during the draw (Nobiai). Also, TSM *planning-spontaneous* pre-trial ($r=-.344$, $p=.05$) correlated significantly and negatively with the force exerted by the string hand. Post-trial TSM *serious-playful* ($r=.366$, $p=.04$) and TSM *planning-spontaneous* scores ($r=.417$, $p=.02$) correlated significantly and positively with the force exerted by the bow hand. Finally, pre-trial TSM *planning-spontaneous* ($r=-.362$, $p=.03$) scores were significantly and negatively correlated with the percentage of successful target hits.

Arousal results

Pre-trial TSM *felt arousal* ($r=.483$, $p=.005$) and TSM *preferred arousal* ($r=.643$, $p=.0001$) item scores recorded were found to correlate significantly and positively with arrow length during the draw. In addition, TSM *felt arousal* pre-trial ($r=-.44$, $p=.01$) and post-trial ($r=-.417$, $p=.02$) correlated significantly and negatively with the force exerted by outwardly rotating the bow hand. TSM *arousal discrepancy* post-trial ($r=-.379$, $p=.03$) was significantly and negatively cor-

Table 1 TSM items' Mean scores and SD's pre and post kyudo trial.

	Pre-trial		Post-trial	
TSM Item	M	SD	M	SD
Serious-playful	1.77	0.69	1.63	0.81
Planning-spontaneous	2.63	1.31	2.63	1.54
Felt arousal	3.57	1.19	3.49	1.34
Preferred arousal	3.51	1.42	3.79	1.54
Arousal discrepancy	−0.06	1.26	0.26	1.22
Effort	–	–	4.89	0.87

Note: TSM effort scores were only considered post-performance as they concern the amount of effort involved in the task

Table 2 Significant correlation coefficients between Telic State Measure (TSM) items and Kyudo performance

	Arrow length	Force (SH)	Force (BH)	Target hit	Successful
Pre-trial TSM					
Serious-playful	−.436*				
Planning-spontaneous	−.618***	−.344*		−.362*	
Felt arousal	.483**		−.440*		
Preferred arousal	.643***				
Arousal discrepancy					
Effort					
Post-trial TSM					
Serious-playful		.366*			
Planning-spontaneous		.417*			
Felt arousal			−.417*		
Preferred arousal					
Arousal discrepancy					−.379*
Effort					.437*

Note: N=9, Trials=4, Total=36, df=30 (due to missing values). *p<.05, **p<.01, ***p<.001
BH=bow hand SH=string hand

related with how successful or not (in Japanese archery terms) subjects perceived their shot had been.

Effort results

TSM *effort* post-trial (r=.437, p=.01) scores were significantly and positively correlated with how successful or not subjects perceived their shot had been.

DISCUSSION

Given that this was an exploratory study with a relatively small number of subjects, it would appear from the results that a number of aspects of Japanese archery performance were related to subjects' metamotivational state and arousal characteristics. Notable pre-trial were findings which indicated that being playful and being spontaneous had a negative relationship with arrow length during the draw, and being spontaneous had a negative relationship with both the force exerted by the string hand and the percentage of successful hits. These results at least partially support pre-experiment expectations about archers' state of mind being concerned with being serious and planning carefully. Anecdotal reports from Japanese archers and teachers confirm that planning plays an important role in Japanese archery. Archers are instructed to think about the various aspects of effective technique prior to shooting. However, during shooting paying attention to, at least, the three most important different actions is difficult.

Pre-trial results suggest that Japanese archers might be more successful if their metamotivational state characteristics were serious rather than playful, planning oriented rather than spontaneous (i.e., those considered with the telic state).

Having higher levels of felt arousal had a negative relationship with the force exerted by the bow hand. (While all three individual aspects of Japanese archery technique described in the Introduction are important, the motion and force of the outward twist of the bow hand has first priority). Conversely, having higher levels of felt arousal and preferring higher levels of arousal pre-trial were found to have a positive relationship with arrow length during the draw. This act requires considerable strength which must be maintained for a considerable time thus requiring appropriate levels of arousal. This finding refutes pre-experiment expectations about ar-

chers' arousal experience. It may be that higher levels of arousal are beneficial to arrow length during the draw, but are detrimental to the outward twisting motion of the bow hand.

Post-trial results indicated that being playful and spontaneous was positively, and having higher levels of arousal was negatively related to the force exerted by the outward rotation of the bow hand. The felt arousal finding matches the pre-trial finding on this item. The positive relationship associated with being playful and spontaneous and the force of the bow hand post-trial contrasts with the relationship with this TSM item found for other aspects of Japanese archery technique pre-trial.

Higher effort scores, post-trial, were positively related to how successful, or not, in Japanese archery terms, subjects perceived that their shots had been. This result was added to by the finding that higher arousal discrepancy results were negatively related to how successful, or not, subjects perceived that their shots had been. In reversal theory, arousal discrepancy is a measure of stress (tension) brought about by mismatches in felt and preferred arousal levels. In other words, the higher this score the more unpleasant an experience it was for the archers. It is understandable that unpleasant experience might be linked to their perception of how well they performed as suggested by the negative relationship between these two aspects of performance.

In summary, being in the telic state prior to arrow release was linked to more effective performance. However, arousal item results were less clear, suggesting that higher levels of felt arousal were beneficial to some aspects of performance, but detrimental to others.

The present results, from both objective and subjective measures of Japanese archery performance suggest that further investigation with larger groups balanced for ability might prove fruitful.

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