

EXPLORING THE EFFECTIVENESS OF PRE-PERFORMANCE ROUTINES IN ELITE ARTISTIC GYMNASTS: A MIXED METHOD INVESTIGATION.

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Abstract

Competitive sport at the highest level demands consistency and precision in the transfer of skill across various environments, on multiple occasions, in order to produce optimal performance (Singer, 2002). Pre-performance routines (PPR) are sequences of motor, emotional, and cognitive behaviours performed immediately in advance of the execution of self-paced tasks (Cohn, 1990). The purpose of this study was to explore both content and variation of pre-performance routines (PPR) between the four apparatus within Women's Artistic Gymnastics. Participants were purposely selected from former Great Britain international, female elite artistic gymnasts (n=9). This study employed a mixed-method, phased design. All participants completed the Test of Performance Strategies (TOPS; Thomas et al., 1999) in phase one. A purposeful sampling mechanism using descriptive statistics from questionnaire results generated five profiles for further qualitative exploration as to the application and effectiveness of PPR's via semi structured interviews. Pen-profiling was used to compare and contrast common themes amongst the preparations for the apparatus. Results indicated differences between vault and beam exercise with regard to pre-performance state and preparation strategies linked to arousal/activation control and cognitive rehearsal. Gymnasts reported prior use of individualised and highly refined routines dominated by imagery and arousal/activation control. Specific PPR strategies were reported for each apparatus with some robust, consistent psychological skills training (PST) components within them. The results from this study demonstrate that each apparatus requires unique preparation strategies with regards to the achievement of an optimal psychological state for performance.

Keywords: elite gymnasts, imagery, females

INTRODUCTION

Women's Artistic Gymnastics is a closed-skill, multi-discipline sport, composed of four individual apparatus

(Vault, Asymmetric-bars, Beam exercise, and Floor exercise). Psychologically, gymnasts are required to cope with the

expectation of a technically perfect performance of their routines, alongside a consistently high risk of serious injury (Post, 2010). With respect for such sport-specific pressures, a consideration for the range of potentially beneficial psychological skills that can be incorporated into the procedures of preparation for training drills and competition performance is valuable, as a means to inform selected rehearsal mechanisms to achieve optimal preparatory states for actual performance.

Pre-performance routines (PPR's) are a combination of cognitive, motor and emotional behaviours performed immediately in advance of self-paced task execution (Cohn, 1990; Lidor & Singer, 2000). PPR's allow for an athlete to intentionally self-regulate arousal (Crews & Boutcher, 1986; Gould & Udry, 1994); divert attention away from task-irrelevant cues (Czech et al., 2004); facilitate the maintenance of the 'prepared' state by preserving psychological and physiological readiness (Schmidt, 1988) and achieve a sustained optimal emotional, confident and focused state immediately prior to and during performance (Singer, 2002). PPR's can also be utilised as training aids to assist with achieving consistent optimal practice performances and to encourage rehearsal of such techniques prior to the pressurised environment of the performance arena. In order for a PPR to be most effective, it should be sport specific, self-styled, individualised to match the athlete's skill level and individual pre-performance preferences, and influenced by the nature of the required task (Singer, 2002; Wrisberg & Pein, 1992).

Previous research has focused on how PPR's have both *influenced* and *improved* performance in sport. A popular method of assessing the effect PPR's have on performance has been the comparison between performances of an experimental group (following a PPR intervention strategy) and a control group (e.g., Hall & Erffmeyer, 1983; Lobmeyer & Wasserman, 1986; Marlow et al., 1998) Although across these studies a clear connection between

PPR use and improved performance is evident, there is a sense that exploring the different aspects of PPR's deemed more functional in supporting different aspects of performance would be useful. Previous literature has also focused on the *duration* of PPR's (e.g., Crews & Boutcher, 1986; Jackson, 2003; Southard & Miracle, 1993). Although the literature suggests there may seem to be some association, the increased duration of psychological preparation has shown no direct link with performance improvement. However, this absence of a direct relationship between duration and performance improvement may be attributed to the content and consistency of the PPR rather than the length of time to complete it.

Generally, the focus of PPR research has been amongst closed skill sports such as golf (e.g., Cotterill et al., 2010) basketball (e.g., Lonsdale & Tam, 2007), volleyball and tennis service (e.g., Lidor & Mayan, 2005), and bowling (e.g., Kirschenbaum et al., 1982). Closed skill events are self-paced in nature, allowing for adequate pre-skill preparation time where environmental conditions are stable and predictable (Singer, 2002). The self-paced nature of gymnastics requires movements that are initiated and controlled by the performer with time for psychological preparation immediately prior to each event. This preparation varies between individuals and events as different internal states and cognitive preparation strategies are required for optimal readiness and performance (Cohn, 1990).

This study will fundamentally explore how former female, elite, artistic gymnasts retrospectively implemented different psychological preparation techniques into their PPR's in training and competition, across the four different apparatus (Vault, Asymmetric-bars, Beam exercise and Floor exercise) with the intention of adding to the information already existent in the relevant literature.

The majority of research within the PPR area of study has taken a quantitative approach, with questionnaires being the primary measurement tool (e.g., Lidor &

Mayan, 2005; Mesagno & Mullane-Grant, 2010). Questionnaires alone can be limiting in scope to explore participant's experiences, true feelings, thoughts, opinions and additional information on the topic in question (Patton, 1990). Qualitative measures allow for detailed accounts of the athlete's personal views and experiences, as research can be based on description, be context specific and allow for in-depth analysis. The present study will follow a mixed methodology of questionnaires in phase one and interviews in phase two. On conclusion the study will offer recommendations for the coach and/or sport psychology consultant as to the understanding of PPR complexity and relevant strategies and techniques to use with elite female artistic gymnasts.

METHOD

Participants

Data were gathered from nine former elite level female gymnasts ($M = 20.55$ years, $SD = 1.81$) who were all previous members of the Great Britain Women's Artistic Gymnastics team. Gymnasts had an average training age of 13.2 ($SD = 1.96$) years, first competed nationally at the average age of 9.2 ($SD = 1.32$) years old, and retired at 18.22 ($SD = 1.56$) years. Gymnasts were purposely selected (Berg, 2009) as they were information-rich and corresponded with specific selection criteria namely being previous members of the GB National squad for a minimum of 18 months during their career, one or more international representation honours ('friendly' or competitive tournament) and retirement from gymnastics within the most recent Olympic cycle. Five gymnasts had competed at World Championships with the remainder at more than one of European Championships, Commonwealth and Commonwealth Youth Games, and at Australian or European Youth Olympic Festivals.

Procedure

Phase 1 – Questionnaire

Prior to participant recruitment, full ethical approval was gained from a University Research Ethics Committee. Participants were recruited via email containing an information letter to explain the purpose of the study and request participation. On receipt of consent participants each completed the Test of Performance Strategies (TOPS) and returned these to the researcher via email within two weeks along with a small number of demographic questions relating to age, participation in gymnastics, retirement age and top three significant competitions. Participants were instructed to reflect on their psychological skill usage from a defined period between when they reached national level and gained International representative honours, until retirement.

Phase 2: Interview

The qualitative approach in essence respects the expert knowledge of the participant and allows for the provision of insights into each participant's personal and unique experiences (Kesby, 2007). As qualitative inquiry typically focuses in-depth on a relatively small sample selected purposefully (Patton, 2002), this was an appropriate approach for this study. Following data consideration and analysis from the questionnaires, 5 participants were selected to take part in one-to-one interviews. These participants demonstrated particularly interesting results (i.e. results worthy of further exploration within the qualitative phase) which indicated very high and low pre-performance strategy usage, including an average scorer to obtain a diverse range of profiles which were than explored in-depth in the interview.

The semi structured interviews were carried out on separate dates within one month of the completion of the questionnaires and following analysis of the results. The interview focused on the TOPS results, with interest towards the prominent subscales from each participant's earlier questionnaire results. Throughout the

interview, participants were asked to discuss psychological techniques used in both training and competition contexts and, where possible, give specific examples of their use. A full interview schedule is available upon request from the author. Each interview was carried out over an average duration of approximately 25 minutes dependent on the detail of the participants' responses. Interviews were audio recorded using a Dictaphone (OLYMPUS, WS-450S, China), and were later transcribed verbatim by the primary researcher into 41¼ pages of size 12 double spaced text.

Within this study credibility and transferability (the qualitative equivalent of internal and external validity, respectively) were demonstrated through verbatim transcription of data and triangulation with an experienced qualitative researcher. Dependability (the qualitative equivalent of reliability) was demonstrated through the comparison of pen profiles with verbatim citations and triangular consensus methods.

Instruments

The TOPS questionnaire was completed to retrospectively assess the participant's use of a range of psychological skills, strategies and techniques in practice and competition contexts. The self-report instrument consisted of a 64-item questionnaire, measured on a 5-point Likert scale (1 = *never* to 5 = *always*) to rate the *frequency* of usage of each psychological skill dimension. Items were split into 16 subscales to target the eight most significant dimensions of psychological skill that produce successful athletic performance; activation, relaxation, imagery, goal-setting, self-talk, automaticity, emotional control and attentional control in competition and practice settings. The subscale "attentional control" was found to be an inappropriate solution within the competition context (Thomas et al., 1999) and was thus replaced by "negative thinking". The maximum score for each subscale of TOPS was 20. High scores indicated greater usage of that mental

skill. The internal consistency of the TOPS subscales were reported to range between 0.66 and 0.81, and reliability coefficients for this test have been reported to range from 0.86 to 0.93 (Thomas et al., 1999).

Data Analysis

Descriptive statistics were calculated for participant's individual overall usage of psychological performance strategies (TOPS results). These acted as a purposeful sampling mechanism for participant selection in phase two. Overall total and mean scores were the focus for selection of each participant to initially identify them for phase two interviews. In order to obtain a variable spread of data, two high scoring, two low scoring and one moderate scoring participant were selected for interview. Raw scores from subscales of the questionnaire were then considered to assist with the selection of specific areas for deeper exploration in the phase two interviews.. For the TOPS questionnaire, this refers to the combined practice and competition score for each subscale. Other subscale scores were selected based on the indication of the greatest difference between practice and competition scores.

Interview data was represented via a pen profile technique. The pen profile method has been used to represent analysis of data sets in the exercise domain originating from young participants, including those from write and draw (Knowles et al., 2013), focus group (Ridgers et al., 2012) and interviews (Mackintosh et al., 2011). The pen profiles were constructed from the transcripts using verbatim quotations taken directly from the interviews (figures 1-5). This process allowed for the efficient emergence of key themes and dimensions within the data.

Data in the pen profiles refers to verbatim quotes that are both specific to the individual apparatus and also to some of the general information relating to PPR strategies that appeared relevant and significant for the discussion of use within the sport of artistic gymnastics.

RESULTS

Phase 1: Questionnaire

Descriptive statistics acquired from the TOPS questionnaire indicated profiles for participants 1, 2, 4, 6, 7 and 8 demonstrated results worthy of further exploration. However, at the time of the second phase, P7 was not contactable due to

unforeseen circumstances. As a result, despite the high scoring nature of their results and incidentally their initial consideration for interview, they were withdrawn from the study, hence the selection and inclusion of other participants (Table 1).

Table 1. *Individual subscale, mean, standard deviation, range and total score of participants for the TOPS questionnaire*

Participant	Activation		Relaxation		Imagery		G-Setting		Self-Talk		Auto.		E. Control		Att. / Neg.		Mean	SD	Range	Total
	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C				
1	10	8	5	12	12	17	11	15	14	10	9	14	13	16	14	6	11.63	3.46	12	186
2	10	17	8	13	17	20	10	17	14	16	14	14	11	14	11	9	13.44	3.41	12	215
3	14	18	8	8	11	18	15	20	16	14	16	12	10	10	14	12	13.5	3.60	12	216
4	14	18	6	12	20	20	14	19	19	18	12	10	4	12	13	8	13.69	5.04	16	219
5	11	14	12	11	12	17	15	15	15	15	12	10	12	13	12	10	12.88	2.06	7	206
6	13	20	13	15	16	20	16	20	17	20	13	10	10	13	14	5	14.69	4.25	15	235
7	10	17	10	17	18	18	14	13	16	19	9	4	12	20	14	10	13.81	4.42	16	221
8	9	15	5	11	10	12	10	12	11	11	11	13	10	12	11	11	10.88	2.09	10	174
9	9	15	9	12	14	17	15	13	13	15	15	13	12	14	13	7	12.88	2.63	10	206
Total	100	142	76	111	130	159	120	144	135	138	111	100	94	124	116	78				

Note. Total values shown in boldface represent the participants selected for phase two interviews. Individual subscale values selected for exploration are also shown in boldface. P = Practice; C = Competition.

The results reveal high scores for P4 and P6, low scores for P1 and P8, and average scores for P2 as shown in table 1. The remaining participants (P3, P5 and P9) were not considered for further investigation in the interview phase due to their moderate

results. All those classified as moderate scoring were contacted for interview as a means to obtain a variable account of PPR strategy usage, however, only one (P2) was available within the timescale of the study.

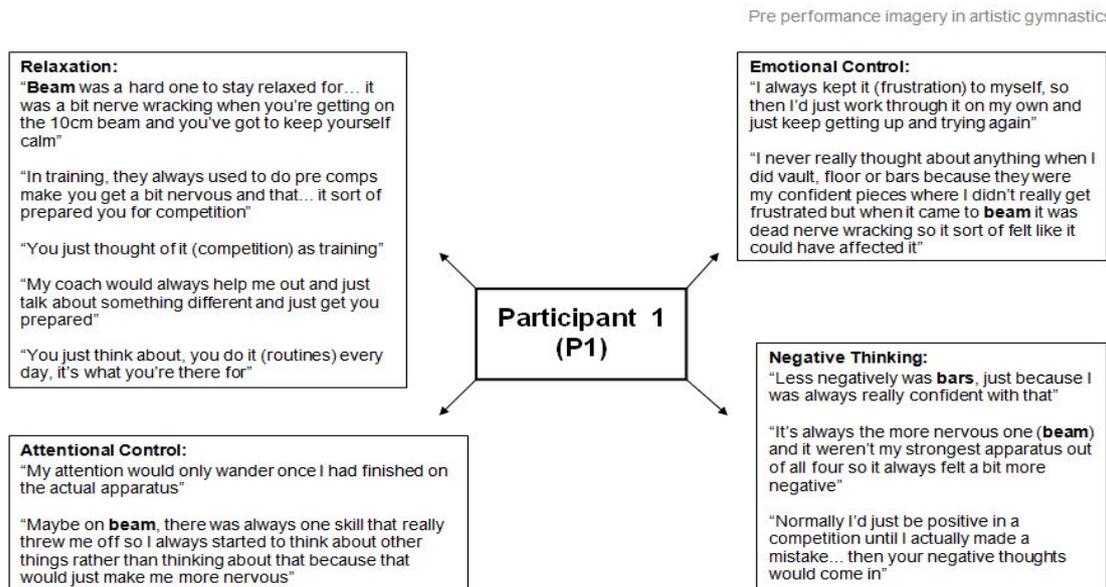


Figure 1. Pen Profile for participant 1.

Figure 1. Pen profile for participant 1 showing verbatim quotations for relaxation, emotional control, attentional control and negative thinking PPR strategies.

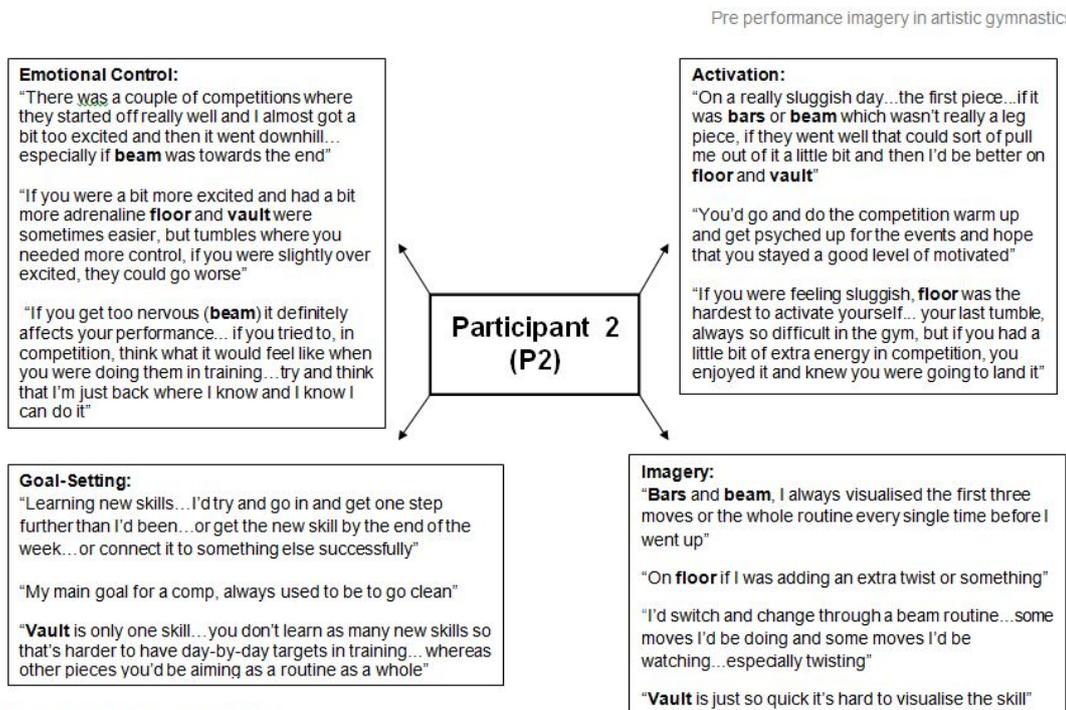


Figure 2. Pen profile for participant 2.

Figure 2. Pen profile for participant 2 showing verbatim quotations for emotional control, activation, imagery and goal-setting PPR strategies.

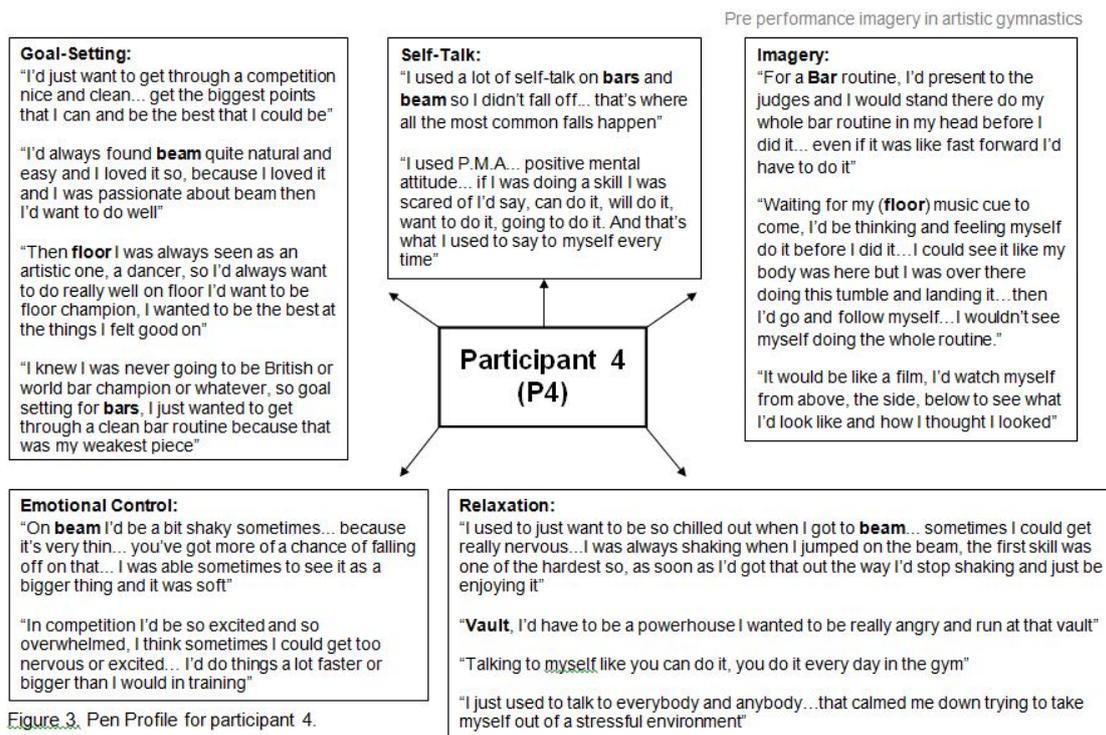


Figure 3. Pen Profile for participant 4.

Figure 3. Pen profile for participant 4 showing verbatim quotations for goal-setting, self-talk, imagery, relaxation and emotional control PPR strategies.

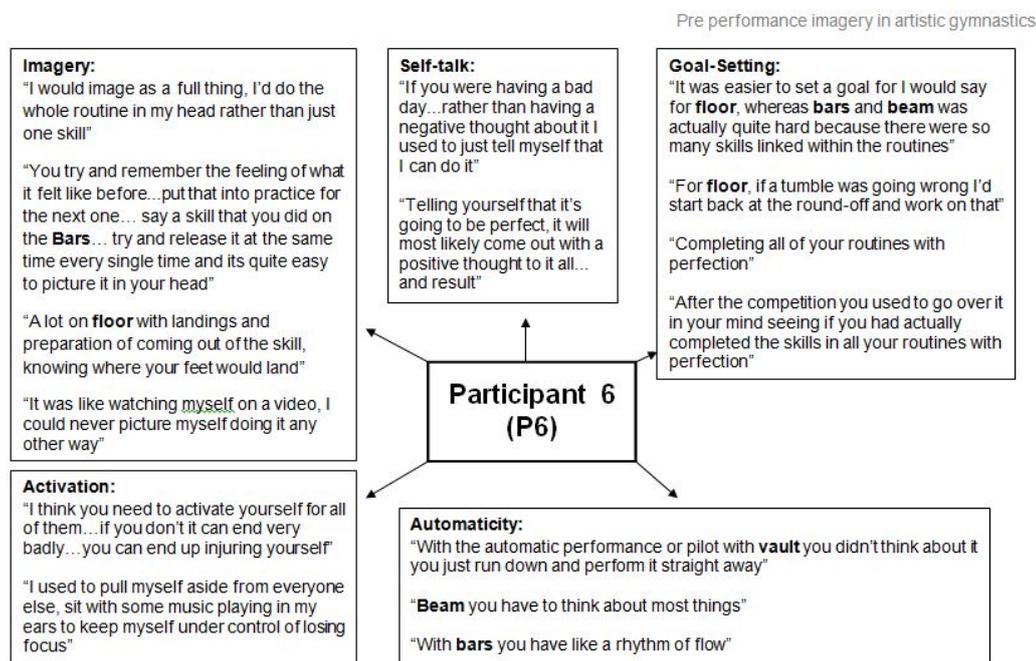


Figure 4. Pen Profile for participant 6.

Figure 4. Pen profile for participant 6 showing verbatim quotations for imagery, self-talk, goal-setting, automaticity and activation PPR strategies.

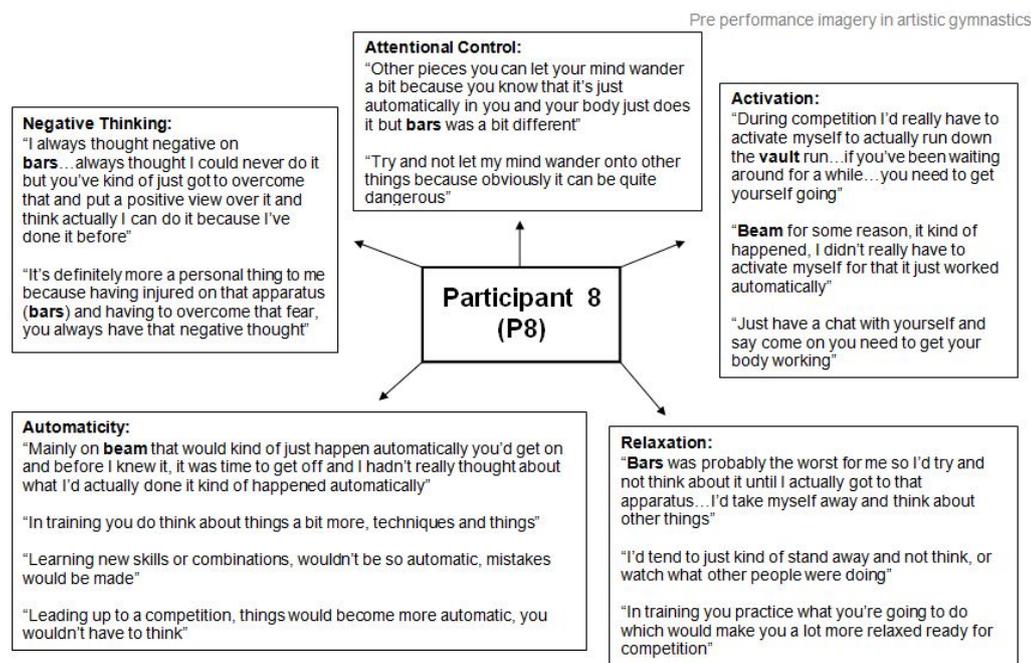


Figure 5. Pen profile for participant 8.

Figure 5. Pen profile for participant 8 showing verbatim quotations for negative thinking, attentional control, activation, relaxation, automaticity.

DISCUSSION

This study aimed to explore the unique variation in pre-performance preparation strategies employed across the four individual apparatus within Women's Artistic gymnastics. Analysis revealed a number of frequently occurring strategies implemented by participants with respect to psychological preparation for the vault and beam exercise. Arousal/activation was noted by the participants as a method for achieving the appropriate performance state for vault while, contrastingly, relaxation appeared principal in obtaining prime pre-performance status for beam exercise. Participants consistently reported the importance of executing a powerful and energetic pre-vaulting approach. Description of a process known as "psyching-up" was mentioned, which has previously been suggested to operate as that of a cognitive stimuli for enhancement of the aroused state, and to be of use for activities requiring power (Weinberg et al., 1985). Within the psyching-up process, participants reported

use of positive self-talk and related imagery mechanisms which have previously been reported as effective stimulatory techniques for dynamic tasks (e.g., Tod et al., 2003). White and Hardy (1998) reported the presence of an aggressive imagery approach in slalom canoeists linked to mood enhancement but, in contrast, gymnasts did not use imagery in this same way. The present study, however, contradicts those suggestions, as the participants described similar tendencies to the canoeists to achieve an 'angry' mind-set prior to vaulting (figure 3).

The data also highlighted the somewhat contrasting pre-performance state required for the beam exercise. Participants consistently associated the width of the apparatus with their own perceptions of anxiety and nerves (figures 1 & 3). Participants perceived that the beam exercise required a particular 'focus' and that inappropriate focus was the most common cause of falls and mistakes and in effect more dangerous than other apparatus. This data highlights the importance of

achieving a state of relaxation both prior to and during beam performance. Imagery has previously been employed as a strategy to calm nerves (Hall et al., 1998) and was among the techniques reported by participants in this study to achieve and maintain relaxation required for the beam exercise. During competition, one participant described imagining themselves in their training environment (figure 2). This simulation of a 'safe' atmosphere seems to have been used effectively to reduce the pressure associated with competition. Mental rehearsal of an environment has previously been reported by other multi event sports such as heptathletes (e.g., Gregg et al., 2007) and more recently gymnasts (Post, 2010). The participants in the present study simulated performance environments in training, in order to familiarise themselves with the competition scenario (figures 1 & 8).

The use or absence of cognitive rehearsal was another contrasting technique applied for the vault and beam. Due to being fast paced and of a short duration, a common response among the participants related to the difficulty experienced with imaging for vault, due to it being a short, dynamic movement (figures 2 & 4). This concurs with research by Post (2010) who also reported difficulties by gymnasts in imaging their vault sequences due to the high velocity of the skill. Participants in Post's work employed a method of imaging the element at a slower pace in order to capture the details of the movement. The participants in the present study appeared to deliberately avoid the use of cognitive imagery, and referred to just allowing the skill to happen with a sense of automaticity, despite the complex nature of vaulting elements, and the potential performance benefit that could be gained from mental rehearsal.

In contrast to this, participants conveyed the need for explicit cognitive control and rehearsal for the beam exercise. Several participants described the visualisation of blocks of skills, or full routines, immediately prior to their

completion in competition (figures 2; 3; 4). This level of cognitive specific imagery has been found previously to be the most frequent type of imagery used by gymnasts as a resource for them to rehearse difficult moves and skill combinations (White & Hardy, 1998).

The asymmetric-bars presented psychological demands that are somewhat distinct to that of the other apparatus. Participants described the need to employ cognitive rehearsal in a similar process as that of the beam exercise. Participants expressed the need to visualise opening sections or whole routines in advance of mounting the asymmetric-bars in competition, even if their images were faster than the real time skills (figures 2 & 3). This illustrates that the participants were able to *control* the speed of their images akin to the findings of Post (2010). Results from the present study contradict in part to that of Post, where it was reported participants' images were slowed down to gain a beneficial effect of individual skill component practice. Participants in the present study, however, reported an increased image speed. Being able to control the speed of an image may be favourable to the gymnast as it would allow for mental practice even when time is limited. This was highlighted by White and Hardy (1998) who noted that rehearsal based strategies proved problematic for gymnasts during the warm up phase of the competition, as they felt pressured to use this short amount of valuable time for physical practice. Therefore, the ability to alter the speed of imagery in view of available time for this technique to be employed effectively may prove advantageous for the gymnast. Frequent use of kinaesthetic imagery has been reported by athletes in sports where proprioceptive cues and timing are crucial (Hall et al., 1990). Participants in this study referred to the use of mental rehearsal to assess and compare the *feel* and *timing* of some of the movements in practice on bars (figure 4). This technique was used as an attempt to automate the sensitive timings of release

skills and allow for the mechanics of skills to develop consistency. This finding illustrates that imagery is multi-sensory and, perhaps, by incorporating more than just an image within their PPR, gymnasts could increase the power of their cognitive rehearsal, especially for the technical nature of bar skills.

Participants reported the lowest use and range of PPR strategies in respect to the floor exercise despite the demands for a wide range of skill types, arousal states and mind-frames. Participants PPR strategies for the floor exercise were akin to those techniques of cognitive rehearsal utilised on bars. One participant discussed a thorough usage of imagery prior to their floor routine (figure 3). As they awaited the music cue they described a powerful 'out of body' experience. Through first visualising and *feeling* the tumble run successfully, subsequently they would 'follow' their body to successfully execute the skill that they had already seen themselves complete. Again, this reiterates the potential benefit of kinaesthetic imagery for the complex skills involved in the majority of a gymnast's performance. It is important to note that the participants only discussed using this cognitive rehearsal technique for the tumble run and skilled movements within their floor routine (figures 2 & 4), they did not seem to apply the same method of practice to their choreography. Gymnasts have also previously reported primarily imaging the skilled parts of their floor routine, with little attention to their dance (Post, 2010). This suggests that imagery of technical elements is prioritised over the more simplistic yet required elements.

Results clearly demonstrated that each participant utilised an individual combination of techniques in a way that was unique and deemed most effective for them. As such this reinforces the findings of Cotterill et al. (2010) and Gregg et al. (2007) with respect to the notion of individual differences in the selection and use of psychological skills and imagery use.

An interesting strategy that emerged as a mechanism for relaxation during the

pre-performance period in competition was that of self imposed isolation and distraction. Frequent references were made relating to how the participants intentionally removed themselves from competitive surroundings and isolated themselves from other competitors as part of their preparation (figures 4 & 5). In contrast to this, other distractive relaxation techniques employed by the participants involved the engagement in seemingly irrelevant (to the task) conversation with their coach or others, in order to distract from the stressful environment (figures 1 & 3). Cotterill et al. (2010) witnessed similar use of deliberate distraction techniques in their study with international golfers. It seems that athletes utilise strategies such as these to avoid the occurrence of any non-constructive or perhaps detrimental thought processes in the period directly prior to performance.

In the present study, imagery was identified as a particularly effective and important skill reported by the participants, which supports the notion from Hall et al. (1990) that imagery usage prior to performance is a crucial skill to develop. With respect to imagery, it is perhaps of use to consider the preferred perspective adopted by the participants. Some gymnasts reported using only internal or external imagery (figures 3 & 4), whereas, others described how they would utilise both approaches interchangeably (figure 2) and is such consistent with findings by Post (2010). As each apparatus requires different pre-performance states it appears gymnasts need to be able to adapt their imagery in relation to the apparatus, as both internal and external perspectives have value for tasks that require the execution of correct form (White & Hardy, 1995). Further reference was made, by the participants, as to the need to experience the kinaesthetic feel for their images which again stresses the importance and skill development required for this technique.

A key limitation within the study relates to the retrospective nature of the research. The sample of participants consisted of retired elite gymnasts, who

were required to reflect upon their experiences prior to retirement, make generalisations and contextualise their answers. Therefore, the research was based on responses reliant on memory recall; something which inevitably decays over time and may have therefore provided imprecise answers. Every effort was made to counteract this with an appropriate 'time-frame setting' and ensuring that examples given were checked as being from the defined time period. Another potential limitation of the study was related to the size and limited sample of participants. The selection criteria was employed to ensure the standard of the sample, however, the number of gymnasts that had attained the appropriate competitive level and also retired within a reasonable time-frame was limited, especially in the UK. It is also important to note that four of the five participants selected for interview in phase two, did in fact train at the same club. Whilst it should be noted that being exposed to the same club environments may be influential to training and thus the strategies employed by the gymnasts, given the individual nature of coaching it is said with some certainty that participants in this club were divided between several principle coaches. It is, also interesting to consider that both P4 (who demonstrated generally high scores) and P8 (low scores) were members of the same club under supervision of the same coach, yet clearly utilised very different PPR strategies in competition and training

Participants involved in this study reported use of PPR strategies which were beneficial to them within both their training and performance. The general age of participants within this research is positively higher than the average gymnast currently competing at national level. Previous research has been conflicting when exploring the effectiveness of cognitive strategies with young athletes. Lidor and Mayan (2005) reported no benefit from the use of cognitive PPR's with young athletes in volleyball. This result may be due to the fact that the sample of participants had no

previous experience in the sport. It has, however, also been found that young athletes are able to learn and use cognitive techniques to enhance their performance (Lidor & Singer, 2000) and they are particularly motivated by opportunities that promote skill development (Wrisberg & Anshel, 1989).

PPR use and development is often related to experience, which usually equates to the chronological age of the athlete. With consideration for the nature of gymnastics and its associated high training age at a low chronological age, it seems appropriate perhaps to suggest that young gymnasts do need to be develop psychological skills to cope with the demands of the sport, particularly for those times in event and pre performance. Findings from this study have shown PPR's to be useful in this quest; however it is recommended that they be developed in conjunction with the gymnast's preferences of PPR strategies and sympathetic to their present level of skills which may change over time as skills or competition demands increase. Further research, perhaps with *current* elite level senior gymnasts would allow the use of strategies employed 'within career' to be examined, thus eliminating the potential of recall bias when using a retired population. It may also be beneficial to explore these findings with gymnasts from other countries in view of influences from different training environments/techniques and regimes.

CONCLUSION

The results from this study demonstrate that each of the apparatus within Women's Artistic Gymnastics requires unique preparation strategies with regards to the achievement of an optimal psychological state for performance. Generally, preparation for the vault was characterised by increased arousal and activation, and although results displayed a lack of cognitive rehearsal, it may be suggested that gymnasts would benefit from the use of imagery for vaulting due to its complex nature and short duration of

performance. Beam preparation was defined by arousal control and relaxation mechanisms, with clear usage of cognitive imagery as a method to manage anxiety and nerves. Similarly, preparation for the asymmetric-bars and floor exercise was characterised by cognitive rehearsal with specific reference to kinaesthetic imagery; a technique which emerged as being particularly important across all aspects of gymnastics. Findings from the present study reiterate the importance of individual differences when developing PPR strategies and imagery use in gymnasts. Results of the study could therefore be used to inform psychological training programmes for gymnasts as they progress through development structures towards that of the senior elite/International competitive environments.

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