TREND ANALYSIS OF COMPLEX RELEASE AND RE-GRASP SKILLS ON THE HIGH BAR

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The purpose of this study was to examine the influence of the Code of Points on the frequency and type of Kovacs performed on the high bar by elite gymnasts. Video recordings of high bar performances were collected from the 2000 Sydney Olympic Games and 2006 Aarhus World Championships. Development of the Kovacs skill within the Code of Points was informed by a trend analysis of the type and frequency of release skills at the two international competitions. Kovacs variations contributed to 50% of the release skills at the Olympic Games and 40% post qualification round at the World Championships. The high frequency of the Kovacs was attributed to the increase in associated difficulty ranking, potential to increase difficulty through shape and twisting option and durability within the Code of Points. Biomechanical analysis is required for further understanding of the completion and development of the Kovacs.

KEY WORDS: Gymnastics, release and re-grasp skill, Code of Points.

INTRODUCTION: High bar performances consist of a unique movement, namely the release & re-grasp skill setting the high bar apart from the rest of the men's programme. Release skills emerged in the early 1950's, opening up a new avenue for skill development, resulting in an increase in innovative release skills at international competitions (Brüggemann *et al.,* 1994). Release and re-grasp skills are mandatory in elite gymnastics high bar routines (Arampatzis & Brüggemann, 2001) and represent a direct means of accumulating high difficulty tariff. Gervais & Tally (1993) associated the performance of release skills in elite high bar routines with a potential to score highly and a small margin for error. Skill complexity is quantified by the FIG via the Code of Points (2008), using an ordinal system, where 'A' is the least difficult and 'F' is the most difficult. The Code of Points is subject to a review every four years, to encompass technological developments, coach and gymnast innovation and increasing levels of ability (Brüggemann *et al.,* 1994). The ordinal scale utilised by the Code of Points has increased five times since 1950, to ensure skills are appropriately ranked and to remove redundant skills (Liang & Tian, 2003). The Kovacs is a highly ranked release and re-grasp skill consisting of a one and half backward somersaults, whilst travelling backwards over the high bar and re-grasping the bar. Six variation of the Kovacs release exist in the current Code of Points (2008) and it has emerged as a key requirement of elite high bar. The six variations of the Kovacs vary in difficulty rating, based on the shape and addition of twists in the flight phase (FIG, 2008). Previous biomechanical research within gymnastics has primarily focused on fundamental and commonly performed skills (Gervais & Dunn, 2003). Skill trends on high bar have moved toward the complex release skills in the last two decades (Brüggemann *et al.,* 1994), as a result biomechanical research has focused analysis on the preparatory long swing and release parameters of these skills. Understanding the completion of these difficult skills is important, particularly in the learning phases, as it enables practitioners and coaches to educate their gymnasts safely and efficiently (Gervais & Tally, 1993). Biomechanical analysis of frequently performed skills with more than one variation can inform coaches regarding the development between variations (Holvoet et *al*., 2002; Irwin *et al.,* 2007). Current skill trends in elite level high bar performances is therefore paramount to coaches and researchers, further developing the link between biomechanics and coaching practice. Therefore, the aim of this study was to investigate and quantify the trend in Kovacs release and re-grasp skills and to evaluate the development of the Kovacs within the Code of Points. The purpose of this study was to further the understanding of the use of the Kovacs and evaluate the influence the Code of Points since the introduction of the skill.

METHODS: Data collection: Elite male gymnasts from 12 and 43 nations performed high bar routines at the 2000 Sydney Olympic Games (OG) and the 2006 Aarhus World Championships (WC), respectively, on a standard 2.65m competition sprung high bar. Seventy-eight and two hundred and twenty six high bar performances were recorded across the qualification round, individual all-around, team and high bar finals from the OG and the WC, respectively. The camera was positioned approximately 35 m away from the high bar and 8 m above the high bar location at the OG. High bar performances from the WC were recorded using a digital camcorder located at floor level and positioned alongside the high bar at a 45º angle to the centre of performance.

Data Processing: High bar performances from the four competition rounds at the OG and the WC were reviewed via laptop (Toshiba Satellite PRO L100), to play back the performance data. Release and re-grasp skill trend analysis was carried out by an experienced gymnastics coach, to ensure successful and consistent skill recognition throughout high bar performances.

Data analysis: The analysis of the high bar performance data from the OG and WC occurred in two phases. Phase 1 of the analysis employed a hand notation system to analyse the trend in release skills. Analysis of the high bar performances began from when the gymnasts initially made contact with the bar, until the gymnast dismounted the high bar. Frequency and type of successful release skills performed at the international competitions was recorded. Release skills were divided into two separate groups based on the flight phases, namely travelling over the bar and non-travelling skills. Travelling over the bar skills were defined as, skills that released the bar and travelled over the bar and re-grasped on the opposing side. Non-travelling skills were defined as, skills that released the bar and re-grasped on the same side of the bar. Successful release skills were defined when the gymnast released and performed the required movements during the flight phase, re-grasped the bar and was able to carry on the routine uninhibited (Holvoet *et al.,* 2002). Frequently performed release skills were identified in Phase 2 of the analysis, which used a review of the Code of Points (FIG, 2008). The review was conducted from the introduction of the frequently performed release skill into and up to the present Code of Points (FIG, 2008). Changes in difficult ranking and skill development were monitored over a 21 year time period (1985 – 2006).

RESULTS: Phase 1. The frequency and type of Kovacs at the OC and the WC are demonstrated in Figure 1. Travelling over the bar release skills represented 79% and 80% of the release skills performed at the OG and the WC, respectively. Four variations of the complex Kovacs release were performed at the OG and the contribution to the overall performance of release and re-grasp skills performed was vast, contributing to over 50% of the releases performed in each competition round. The tucked Kovacs was the most frequently performed Kovacs variation throughout the OG, contributing to 31% of the overall releases performed. The performance of the full twisting tucked Kovacs increased in the high bar final to 25%, equivalent to the tucked Kovacs, subsequently increasing the percentage performance of the Kovacs skills in the OG high bar final to 65%. The trend in performance frequency of the Kovacs continued at the WC post the qualification round. Post qualification, the four variations of the Kovacs contributed an average of 40% of the release skills performed in each round at the WC. The number of Kovacs variations increased with the performance of the full twisting straight Kovacs. The full twisting tucked Kovacs was performed in each competition round and was the most frequent release performed in the WC high bar final.

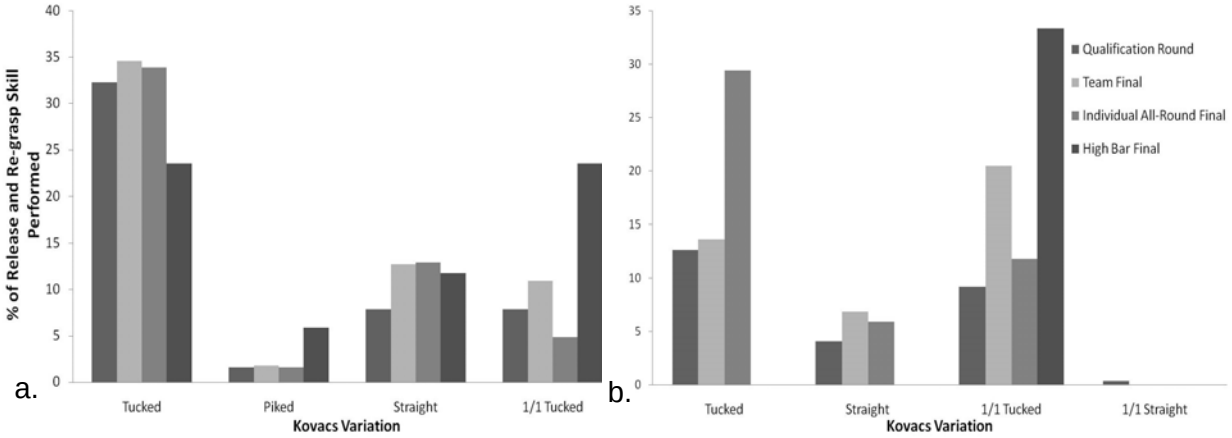

Figure 1: Type and frequency of release and re-grasp skill the Kovacs, performed during the qualifying round, team, individual all-around and high bar finals at the OG (a) and the WC (b)

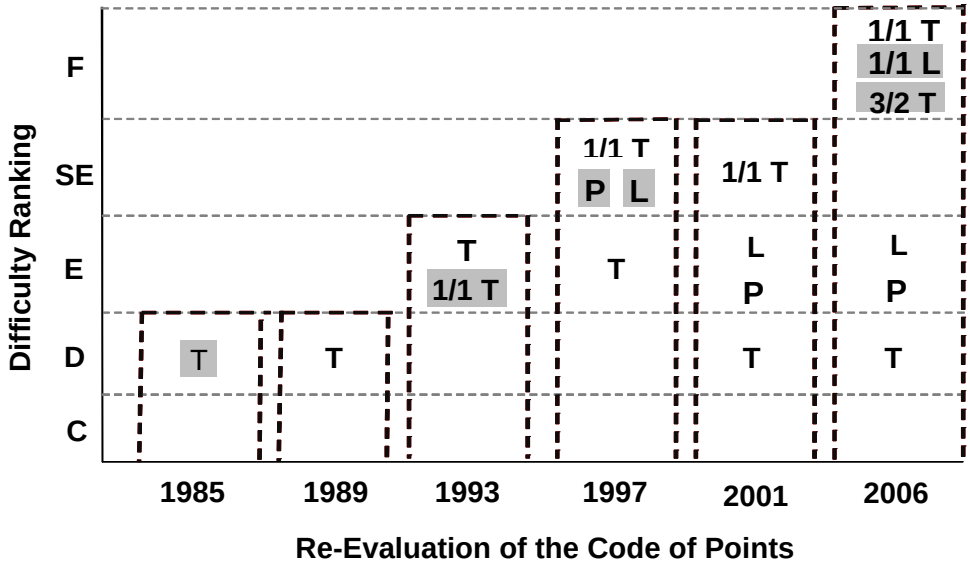

Figure 2: Evolution of the Kovacs within the Code of Points. Tuck (T), Pike (P), Straight (L), Full twisting (1/1) and one and a half twisting (3/2) Kovacs variations. Difficulty maximum of the respective Code of Points is marked by dashed line (FIG, 1985 – 2006). Highlighted Kovacs variation represents introduction to the Code of Points

Phase 2. The evolution of the Kovacs release skill on the high bar, in parallel with the Code of Points is illustrated in Figure 2. The Kovacs release skill has evolved from the basic tucked Kovacs introduced in to the Code in 1985 (FIG, 1985), with the introduction of the piked, straight, full twisting tucked and straight and the one and half twisting tucked Kovacs (FIG 1993; 1997; 2006). The new variations of the Kovacs entered the Code of Points in the top difficulty of the respective Code of Points. The tucked and full twisting adaptation of the Kovacs upon entry to the Code of Points remained in the top difficulty for three cycles (12 years) and to the current Code of Points, respectively. Post entry the piked and straight Kovacs were re-evaluated and placed in the E difficulty, simultaneously the tucked Kovacs was reduced to a D ranked skill. In the current Code of Point the full twisting straight and the one and half twisting tucked entered the top difficulty ranking.

DISCUSSION: Phase 1: The relatively high frequency of travelling over the bar releases compared to the non-travelling releases, could be due to the position of the gymnast at re-grasp, as a majority of non-travelling skills re-grasp below horizontal, therefore requiring the use of compensatory movements to continue the routine successfully (Cuk, 1995). The tucked Kovacs was the most frequently performed release and Kovacs variation at the OG and was the joint highest in the high bar final. The increase in full twisting tucked Kovacs during the OG high final could be associated to the high skill level of the gymnasts competing and therefore performing the most complex skills (Brüggemann *et al.,* 1994). Kovacs

releases made up 40% of the releases performed at the WC post qualification. Fluctuation in the frequency of releases in the qualification round could be associated with the ability level of the gymnasts, resulting in an increase in lesser ranked releases (Brüggemann *et al.,* 1994). The full twisting tucked Kovacs was performed throughout and was the most frequent release performed in the WC high bar final. Kovacs variations increased at the WC with the development of the full twisting straight Kovacs, increasing the difficulty level of the Kovacs grouping. Increase in full twisting tucked and decrease in piked and straight Kovacs frequency, between the two international competitions could be related to alteration to the difficulty ranking of the skills within the Code of Point (2006).

Phase 2. The Kovacs has undergone expansion, in terms of skill development since introduction to the Code of Point in 1985. Alteration to shape and addition of twists has resulted in an attractive structured development pathway, consisting of six variations. All new variations of the Kovacs entered the Code of Points in the top difficulty ranking and demonstrated longevity, where other releases such as the Tkachev have decreased upon re-evaluation (FIG, 1997; 2001). Tucked and full twisting tucked Kovacs exhibited good stability within the Code of Points, maintaining top difficulty ranking for a number of years, which would prove beneficial to elite gymnasts, as career length increase. Historically, the Kovacs has offered a respectably high associated difficulty value for all variations, particularly in comparison to other release skills. This is evident in the current Code of Points, with all six variations, from the basic tucked to the full twisting straight, offering high difficulty ranking.

CONCLUSION: The findings of this study established the Kovacs as frequently performed and important release skill at the international level. The Kovacs and variations popularity stems from the development from the basic to the complex variation, associated high difficulty ranking of the releases and durability within the Code of Points. This study highlights the Kovacs release as a requirement of international male gymnasts and the need for biomechanical investigation, to further the understanding of the completion of the Kovacs variations and provide an insight into the development between variations of these skills. This research provides a platform for future trend analysis at major competition, in parallel with examination of the Code of Points to build on current findings and develop a greater understanding of the role of the Kovacs in elite gymnastics.

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