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Perception of Individual Rugby Player Performance and the Impact of Non-Performance on Statistical Analyses

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Abstract
The Eagle Rating is a measure of perceived individual rugby player performance. This paper discusses the underlying assumptions that are evident in its creation. The issue of non-performance by an individual is explored and the potential impact of non-performance on statistical results examined.

Introduction
Sport statistics are an addition to the entertainment package provided by the media. The primary purpose of these statistics is to give an impression of the ability or performance level of competing individuals. To use these statistics effectively the underlying assumptions must be understood so that any potential limitations can be identified. This paper focuses on the Eagle Rating, an objective rating system extracted via statistical analyses for individual rugby players in first class rugby. The exact details of how the Eagle Rating is calculated is inconsequential for this paper. However, the methods and assumptions that provide the framework are important. These are discussed in part through the body of this paper. Essentially the Eagle Rating is based on the following premise: ability is inferred from performance, which is inferred from the combination of the successful and unsuccessful completion of physical tasks. It is for this reason that the effect of non-performance by a player in a single match needs careful study.

The first section of this paper looks at the justification of a statistical performance barometer in rugby. The underlying assumptions are examined before the potential effect of non-performance is discussed. Finally an exponentially weighted moving average is suggested as the best method of estimating player ability as it reduces the susceptibility of the performance measure to match volatility.

The Eagle Rating as a Sport Statistic
The theme of the Eagle Rating is no different to any other sport rating system, such as Cricket's Pricewaterhouse Coopers Rating (Formerly known as the Deloitte Rating, Coopers and Lybrand Rating) (Berkmann, 1990) and Baseball's PGP (Player Game Percentage) (Bennet, 1992). All are designed to indicate how well an individual has performed in a match situation. This then enables a competitor's ability or their worth to the team to be assessed. However, this assumes that the occurrences on field relate directly to the individual's ability. Whilst this discussion focuses on rugby, parallels can be drawn to other sports. Unlike cricket or baseball, rugby has few defined outcomes that represent successful contribution in a match context. That is from a competitive team perspective, batsmen have played well if they have scored runs, but a winger in rugby can have played extremely well, yet not scored any points. Rugby performance must therefore be measured on successfully completed tasks such as the number of players beaten or the number of metres run on attack.

Instead of quantifying ability through structured tests, the search for rugby ability must focus on unstructured rugby match participation, with the assumption that over time the nature of an individual's ability will be imposed on collated statistics. Each time an individual participates in a game of rugby, this can be viewed as a sampling opportunity. Essentially the game becomes a forum by which individuals express their inherent ability.

In sport, skill must be perceived as sporting performance which tends to increase the probability of success (Thomas, 1970). Further, sports skill can be defined as "any behaviour which tends to improve performance in sport (Thomas, 1970, p.126)". According to the Oxford Senior Dictionary (Hawkins, 1990), the combination of skills gives rise to ability. This definition fits nicely with rugby terminology and the continual reference to a player's skill set by coaching staff determining player value (Stewart, 1987; de Lacy & Fox, 2000). Thus sporting ability is defined as the combination of skills that tend to

improve the performance in sport and it is possible to measure these skills as outlined in the definition of ability. However, it must be noted that there is a difference between what is measured, and what is inferred from this measurement. This is an important distinction and a critical assumption that underwrites the development of the Eagle Rating. Skill is inferred from performed tasks. Tasks are directly measurable (countable) and to complete the task successfully, the skill to perform such a task must exist. Mental and physiological tasks that contribute to the performance of a physical task, such as passing the ball, are not directly measurable from a game and are inferred from the performance on physical tasks. Thus skill also comprises the set of mental, physical and physiological tasks that are required to increase the probability of success. To successfully perform a physical task, such as kicking the ball in a game situation, the other factors that comprise skill must also be successfully performed. Therefore by measuring physical tasks, skill can be inferred as the physical task cannot be completed unless the full set of tasks that comprise the skill (physiological, physical and psychological) are completed. Consequently, quantified skill is inferred from quantified tasks. As ability is the combination of skills, by combining the measurement on tasks, ability is quantified. Therefore to measure sporting ability, we need to measure quantitatively the sporting skills of an individual. By measuring the performance on physical tasks one can infer the level of an individual's skill from the univariate data relating to physical tasks in our possession. The skill set of an individual to tackle, catch, kick, and evade defenders is evident within the data set. This provides the justification for calculating a value such as the Eagle Rating. Figure 1 is a schematic representation of the discussion presented, incorporating m measurable physical tasks that can be explained by n skills from which ability is inferred. A note of caution must be included at this point: It would be naive to assume that an individual's ability to play rugby could be completely described by a set of numerical measures. However, a large portion of an individual's talent is expressed, exemplified by the desire for such statistics in the media.

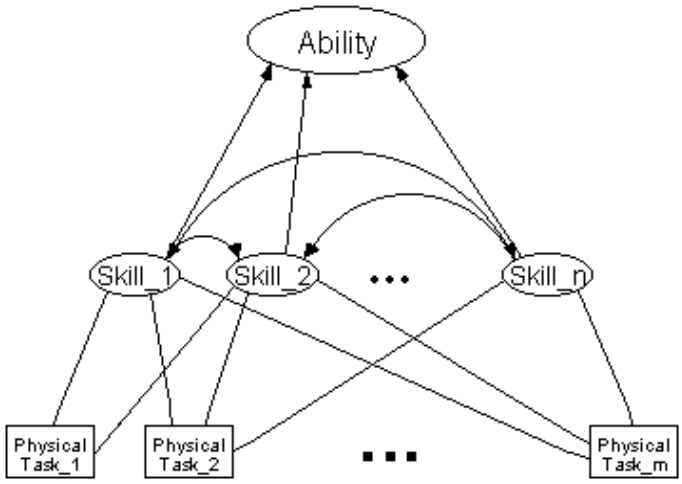

Figure 1. *Schematic Representation of Ability Incorporating Physical Tasks*

Collection of match data referring to individual physical tasks is a primary starting point for quantifying performance leading to the inference of ability. Multivariate analyses provide the techniques to reveal the structure of ability via the typical multivariate profile that is expressed from many match situations. The greater an individual's ability to play the game, the greater their capacity, and therefore the greater their potential involvement in the game. Every time a task is performed a statistic is recorded from a match type situation, the existence of some associated skill can be supported. Work rate is especially obvious in the statistics that are generated. The more often a player is involved, the higher their work rate. Obviously, the higher the successful involvement, the greater the individual's inferred ability.

Fitness and mental skills are core components of rugby ability. Whilst not directly measurable from a rugby match, existence can implied. When a skill cannot be replicated in a game environment due to either a lack of mental application or fitness, the absence of such data will suggest potential weakness. Specifically, what is the point of a player being able to wrestle the ball of any opposition player if that

individual can never get to a situation where that skill is required due to lack of physiological attributes such as fitness and mobility? This example acknowledges that confounding variables such as fitness and mental attributes do not pose a problem. The mediating effects will influence task performance which is manifested in the displayed skill-set recorded in a match situation. However, as our perception of individual performance is based upon the occurrence of events and the measurement of physical tasks in a match situation, we must also consider factors that restrict an individual from performing to the level expected. This leads us into the area of non-performance.

Non-Performance

We will define non-performance as a performance by an individual that is much less than expected by a given individual in a specified position. The handling and interpretation of non-performance data is crucial in how the information generated by a rating system is generalised and used in statistical inference. Importantly, non-performance does not always relate to an individual's ability. Three key areas can be isolated: 1) player inferior, 2) player superior (over-targeted), and 3) game structure. The first situation is of no concern as it is expected that the successful contribution of inferior individuals to the on-field performance of a team will be minimal. However, the two remaining areas are of concern as both are related to match volatility due to the dynamic and chaotic structure imposed by all participating individuals.

A superior player may find that they are targeted or over marked in a match context. From a team perspective this can be favourable by creating space and opportunities for other team members. However, from an individual perspective, the individual's involvement will appear less than expected. Thus if ability is inferred from a solitary match based solely on the individual perspective, the ability or overall performance of that individual will be deemed to be less. This brings into question any inference regarding player ability from a solitary match. Similarly the structure of the game may not allow an individual to become involved to the extent expected. This may be due to tactics, weather or even the performances of other co-operating or competing individuals.

However, by considering many sampling situations, it is expected that an individual will have encountered many different rugby situations enabling true ability to be determined in the longer term. Further, overtime, a player will develop strategies that enable appropriate involvement. This may involve the development of skills such as the 'chip and chase' a 'side-step' or 'swerve', a 'dive pass' and so forth. Also teams will be encountered who are of insufficient ability to "remove" the superior individual from the game. Thus to have an accurate perception of individual performance several matches must be considered.

This is contrary to the adage "You are only as good as your last game", which implies assessing match performance purely on a match by match basis. However, due to the potential impact of non-performance, variable match conditions and the differing standard of opposition presented at each sampling situation, past performance must be included to produce reliability. This can be achieved by implementing an exponentially weighted moving average. This is not a novel approach, the Pricewaterhouse Coopers algorithm for rating cricket players incorporates a weighted average allowing past performance to have some impact on the current perception of ability (Berkmann, 1990). Due to the physicality of rugby an exponentially weighted moving average is more suitable than a simple moving average.

Impact on Statistical Analyses

The most applicable arena for statistics such as the Eagle Rating is ranking and selection. From a statistical perspective this involves the comparison of numerical measures. These numerical measures are estimates of the attributes of interest, such as ability. Means and variances can be obtained and implemented quickly. However, to be of most use time series of these measures must be examined. Ability cannot be assumed to be static, thus data must be observed sequentially allowing any change in ability to be identified.

It is inappropriate to compare individuals on the basis of one-off match observations due to the reasons outlined previously relating to match volatility. Whilst it is tempting to compare individual's participating in the same match, this must be approached with caution, due to the influence of game structure. However, a weighted rating of perceived ability over several matches provides an ideal comparison as it considers ability as an evolving entity. Utilising a weighted average, comparisons can be made within and between individuals from season to season, before and after interventions such as injury, technical corrections and the influence of coaching regimes.

It must also be remembered that the data collected is happenstance, bringing about it's own set of cautions detailed by Roberts (1992) as follows. Firstly, caution must be exhibited when attempting to infer causation. For example excessive tackle counts by an openside flanker inferring high defensive involvement may not be the cause of an abnormally large number of turnovers by the inside backs of the opposition. Secondly, overreaction to extreme individual observations must be tempered. For example, an apparent excess of handling errors may be due to environmental conditions, not a deterioration in handling skills. As discussed with reference to non-performance, this can achieved via a dampening process such as an exponentially weighted moving average.

Conclusion

Holistic individual rugby player performance is inferred from the performance on physical tasks that occur in matches. However, the involvement of an individual on certain tasks can be restricted by a number of factors, thus giving a reduced impression of that individual's ability. By taking an exponentially weighted moving average, past performance is considered, reducing an individual's vulnerability to match volatility. This provides a more stable approximation of an individual's ability in the game of rugby.

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