The Relative Age Effect in Soccer: Cross-Cultural Evidence for a Systematic Discrimination Against Children Born Late in the Competition Year

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Previous findings of skewed birth date distributions among sports professionals have been interpreted as evidence for a systematic discrimination against children born shortly before the cut-off date for each age grouping. Alternative explanations for these findings exist, however. This research therefore attempted to replicate the effect in a cross-cultural comparison. A strong relative age effect in professional soccer was found in Germany, Japan, Brazil, and Australia, showing that the effect is independent of different cut-off dates and a variety of climatic and sociocultural factors. A shifted peak in the birth date distribution of Australian soccer professionals paralleling a corresponding change in the cut-off date in Australian soccer in 1989 was also established. This pattern of results provides strong evidence for the cut-off date in youth soccer as the main cause for the relative age effect in professional soccer.

Many children withdraw from organized sport at one time or another. Gould (1987) estimated that in the U.S., 35% of children drop out of organized sport each year. Although a temporary or permanent withdrawal from one sport or another might be an integral part of child development (Weiss & Chaumeton, 1992) and therefore nothing to be worried about, Barnsley, Thompson, and Barnsley (1985) argued that a systematic discrimination against certain children does exist. For

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example, there is evidence of a highly skewed distribution of birth dates among professional ice-hockey players in the U.S.-Canadian National Hockey League (NHL). Barnsley and colleagues (1985) suggested that this skewed distribution was the result of the cut-off date that determines age grouping in minor hockey. As a result of this age grouping, children born shortly after the cut-off date are up to a full year older (or 2 years in the case of a 24-month band) than late-born children in their respective age group, whereas children born shortly before this date suffer from being promoted to a higher age group almost a year earlier than those born only a few days later. The higher age of children born early in the competition year should give them a competitive advantage over their younger peers owing to their advanced physical development. Experiences of success for the older children in each age group are more likely encouraged, whereas younger children are frustrated by their limited ability to compete and finally drop out of organized sport (Barnsley et al., 1985). After several years of unequal competition and treatment, the birth date distribution of the remaining children is therefore likely to exhibit the distinct skew that was first observed by Barnsley et al. (1985).

The influence of relative age on scholastic achievement is a well-documented phenomenon in educational psychology (Bell & Daniels, 1990; DeMeis & Stearns, 1992; Dickinson & Larsen, 1963; Hauck & Finch, 1993). However, there seems to be an important difference between the relative age effect in school and sports. This difference might be the result of compulsory school attendance as compared to voluntary participation in sport. Although age-related differences in cognitive ability and performance at school entry do exist (May & Welch, 1986; Sweetland & De Simone, 1987), they seem to level out in subsequent years (Hauck & Finch, 1993; Kinard & Reinhzer, 1986; Langer, Kalk, & Searls, 1984). This might be the result of younger pupils needing to work harder to compete with their older peers and the special care that is taken for weaker children in school. Russell and Startup (1986) even showed that the difficulties younger pupils experience in mastering their academic work can finally lead to superior performance at the graduate level, where success is determined by high motivation and persistent efforts rather than a relative age advantage. In sport, however, the existence of a relative age effect is less well-recognized, and to date, no strategies have been implemented to combat the negative consequences of relative age in the sport context. Children are therefore likely to drop out rather than continue voluntary participation until their age disadvantage has been overcome.

In previous studies, a relative age effect was shown to exist in Canadian ice hockey (Barnsley & Thompson, 1988; Boucher & Halliwell, 1991; Boucher & Mutimer, 1994), American baseball (Thompson, Barnsley, & Stebelsky, 1991), and European soccer (Brewer, Balsom, & Davis, 1995; Brewer, Balsom, Davis, & Ekblom, 1992; Dudink, 1994; Verhulst, 1992). In spite of the growing number of such findings, it is important to note that all published evidence for a relative age effect in sport is based on correlational data that do not discriminate between the cut-off date in the respective sports and other factors that may influence the distribution of professional players’ birth dates. Therefore, it cannot be taken for granted that an observed diverging distribution of sport professional’s birth dates as compared with those of the general population is causally influenced by the respective sport’s cut-off date. Further, some research (in football, basketball, and baseball) shows no relative age effects (Daniel & Janssen, 1987; cf. Thompson et al., 1991). Moreover, alternative explanations for seasonal variations in birth rates of sports
professionals in terms of sociocultural, environmental, and biological influences exist. The following discussion reviews some of the factors that may produce the same skewed distributions as would a relative age effect.

First, the relative age effect is possibly mediated by variables closely related to the person's chronological age. Wendt (1974) pointed out that significant phases in a child's development, such as first sitting up, walking, and so on, occur at a fairly constant time after birth. Therefore, anything that is triggered in such phases might produce lag effects that are incorrectly attributed to the date of birth and the applicable cut-off date. According to this reasoning, it may be the warm weather during important phases of motor learning and first outdoor activities that promotes the sports careers of children born in certain months of the year.

Second, Pasamanick, Dinitz, and Knobloch (1960) presented data indicating that the degree of seasonality in the birthday distribution of the general population (i.e., the numerical difference between the maximum number of births per month and the minimum in a given year) is related to socioeconomic class. In lower socioeconomic groups, there was a strong peak in the summer months and a lack of births in spring, closely paralleling the pattern predicted by the relative age effect hypothesis. The seasonality exhibited by the upper classes was insignificant. Since playing soccer (at least in Europe) traditionally is a sport most popular with the lower classes (Murray, 1996), this finding offers an alternative explanation for a skewed birthday distribution among soccer professionals. If existing seasonality trends are more pronounced in the lower classes from which most professional players are recruited, the coincidence of a cut-off date with already existing birth peaks in certain months of the year can result in apparent relative age effects. Smithers and Cooper (1984) indeed found evidence that a higher proportion of manual workers as compared to nonmanual workers are born in the autumn and winter months in England. This finding can easily be reconciled with the 1.6:1 ratio of professional English soccer players born from September to February as compared with those born from March to August as reported by Dudink (1994).

Third, cross-cultural comparisons have shown that seasonality of birth increases with lack of industrialization, poverty, and rural living, whereas in more developed regions and countries the season of birth is relatively uniform (Cowgill, 1966; Rosenberg, 1966). Although we are not aware of direct evidence that soccer players are over-represented with respect to these attributes and therefore this point has to remain speculative, any link between participation in competitive youth soccer programs and one of these factors would offer an alternative account of apparent relative age effects.

Fourth, personality traits such as extraversion have been shown to be influenced by climatic factors. Forlano and Ehrlich (1941), Mayo, White, and Eysenck (1978), Smithers and Cooper (1978), and Fourie (1984, 1985) all found higher extraversion scores among summer-born than winter-born individuals. If such personality traits in turn influence the choice of recreational activities, they might mediate the influence of seasonal factors on the birth distribution of sport participants.

Finally, Wendt (1974) and Barnsley, Thompson, and Legault (1992) pointed out that any hypothesized age-effect has to be separated from possible influences of the cut-off date for school entrance that was shown to be an important factor on several cognitive and academic dimensions (Doornbos, 1971; May & Welch, 1986; Sweetland & De Simone, 1987). In countries in which the cut-off date for school
entrance coincides with the cut-off date applicable in youth soccer, the relative age advantage at school might prove to be a confounding effect by giving older athletes an additional developmental stimulus.

Taken together, there is a significant number of competing explanations for the data claimed to indicate a relative age effect in soccer in previous studies. A more thorough test seems warranted before firm conclusions can be drawn.

In order to replicate previous findings for other European countries, we tested whether a relative age effect can be found in Germany. As in most European football associations, a cut-off date of August 1 applies in Germany as is recommended by the world soccer association, FIFA.

The same cut-off date also applies in Brazil. However, the periodicity of birth dates in the southern hemisphere is exactly the reverse of that of the northern one, paralleling the reversed seasons and climates (Cowgill, 1966). A 6-month shift in the pattern of birth dates of soccer players in Brazil would therefore suggest an influence of season or climate, whereas effects due to the cut-off date (or other sociocultural factors) should lead to a pattern that parallels those in the northern hemisphere. For this reason, we tested whether a relative age effect exists in Brazil.

Sociocultural factors other than the cut-off date that may be associated with certain months of the year cannot be identified by comparing the northern and southern hemispheres. However, they can be detected by comparing countries for which different cut-off dates apply. Traditionally, in the Japanese soccer system, a cut-off date of April 1 applies. A distribution of birth dates peaking in the months following April is not to be expected in Japan if sociocultural factors are responsible for the autumn peak that was observed in several European countries. The persistence of a shifted peak shortly after the Japanese cut-off date of April 1, however, would support the notion of a universal relative age effect associated with the respective cut-off date.

Unfortunately, as in European countries, the Japanese cut-off date in soccer coincides with the cut-off date for school entrance. A final, more conclusive test is possible, however, by directly observing the consequences of a change in the cut-off date. Fortunately, one country, Australia, changed its cut-off date in 1988 from the traditional January 1 to the date proposed by FIFA in August. A corresponding shift in professional players’ birthday distribution would provide very strong evidence for a relative age effect that is mediated by the cut-off date in competitive youth soccer programs.

**Method**

**Subjects**

For each country under consideration, a sample consisting of all players in the highest professional soccer league was investigated. Foreign players were excluded from this analysis. Because of the very high number of foreign players in Japan, the Japanese reserve players of each club’s satellite team were included in the Japanese sample. The samples thus obtained consisted of 355 players in the 1995–1996 season of the German Bundesliga (Kicker, 1995), 486 players in the 1995–1996 season of the highest professional soccer league in Brazil (van Hoof & Parr, 1995), and 360 players in the 1993 season of the Japanese J-League (Hiratsuka, personal communication). Two samples of professional soccer players in the highest
soccer league in Australia were investigated, one drawn from the 1988–1989 season \((N = 207)\) and one from the 1995–1996 season (Australian Soccer Annual, 1988; Australian Soccer Yearbook, 1995). Only players born after 1974 \((N = 61)\) were included in the 1995–1996 sample because only the youngest players in this season grew up with the new cut-off date in August that took effect in 1988.

Data

For each league, the distribution of professional players’ birthdays was computed by month. These birthday distributions were then compared with that of the general population. For Germany, the expected number of players was computed on the basis of general population birth statistics provided by the German Federal Agency of Statistics for the year 1970, since this is a year that roughly corresponds to the average year of birth of a professional soccer player in Germany. For Brazil, Japan, and Australia, birth date statistics were obtained for the oldest year for which records were available. The birth date distribution of Brazilian soccer players was compared with birth statistics provided by the Brazilian Center of Documentation and Information for the year 1975. The expected number of players in Japan was computed on the basis of birth statistics provided by the Japanese Statistics and Information Department for the year 1975. The birth date distributions of the two Australian samples were compared with Australian Bureau of Statistics birth statistics for the total population of Australia in 1985. The distributions of birth dates as determined on the basis of the applying cut-off dates—August 1 for Germany and Brazil, April 1 for Japan, January 1 for Australia 1988–1989, and August 1 for Australia 1995–1996—are given in Figure 1, separately for professional soccer players and the general population. Following Barnsley et al. (1985), the data were aggregated for each quarter of the competition year to enhance clarity of presentation.

Procedures

Because a chi-square test for differences between the expected and observed number of players cannot shed light on the existence of trends in the data (as were expected given a relative age effect), the predicted linear relationship between month of the competition year and participation rate was examined by calculating the Spearman-rank correlation coefficient between the month of the competition year—according to the applying cut-off date—and the difference between the expected and observed number of players for each month. For example, in Germany, a rank of 1 was assigned to August because of the applying cut-off date of August 1, and a rank of 12 was assigned to July, since this is the last month of the competition year in Germany. For each of the 12 months of the competition year, the expected number of players was then computed on the basis of general population data. The difference between the observed number of players and the expected number of players was computed and rank-ordered next. In the following analyses, a significant rank correlation between the month of the competition year and the rank of the difference between observed and expected number of players indicates that more of the players were born early rather than late in the competition year (Boucher & Mutimer, 1994; Thompson et al., 1991).
Figure 1 — Birthdate distributions of professional players in the highest national soccer league and the general population. Months included in each quarter differ according to the applicable cut-off date: August 1 for Germany and Brazil, April 1 for Japan, January 1 for Australia 1988–1989, and August 1 for Australia 1995–1996.

All significance tests were conducted one-tailed according to the direction of the investigated effect. The level of significance chosen was .05.

Results

In the German Bundesliga, the Spearman-rank correlation between the month of the competition year beginning in August and the difference between expected and observed number of players per month is very strong ($r = -.73$, $p < .01$). The negative sign of the correlation indicates that players born early in the competition year are overrepresented among the 355 German soccer professionals as was expected if a relative age effect exists. As can be observed from Figure 1, the relative
age effect in Brazil ($N = 486$) is also strong ($r = -.53$, $p < .05$). Among the 360 Japanese soccer professionals, the Spearman-rank correlation—as determined on the basis of the Japanese cut-off date of April 1—is even stronger ($r = -.87$, $p < .0001$). In Japanese soccer, too, a very strong relative age effect exists (cf. Figure 1).

In the Australian sample from 1988–1989 ($N = 207$), there is also a pronounced relative age effect ($r = -.76$, $p < .01$). This effect, albeit somewhat weaker, is still present among the youngest players in the 1995–1996 sample ($N = 61$, $r = -.45$, $p < .07$), although the competition year started in August rather than January for these players, a fact taken into consideration in the computation of the effect. Perhaps owing to the small number of young professionals and the fact that the change of the cut-off date took place in the middle rather than the beginning of these young players’ careers, the effect only approaches significance. However, it must be noted that the relative age effect due to the old cut-off date is no longer present among the younger players in the 1995–1996 season ($r = -.08$, $p > .80$). This finding provides strong evidence that the change of the cut-off date led to a corresponding shift in the relative age effect in Australia.

Finally, the amount of variance in the birth date distribution attributable to the relative age effect was determined by regression analyses. This was done by modeling the differences between the expected and observed numbers of players in each month as the dependent variable in regression analyses based on the month in the competition year as the predictor variable. Month of birth explained 54% of the variance in the differences between the expected and observed distributions of professional players’ birth dates in Germany. The amount of variance explained for other countries was 21% in Brazil, 81% in Japan, 54% in the 1988 season in Australia, and 23% in the 1995 season in Australia.

**Discussion**

Despite large differences among the four countries, a strong relative age effect in professional soccer could be demonstrated for Germany, Brazil, Japan, and Australia. The effect was thus shown to be independent of any particular cut-off date. The findings replicate results found in previous studies for France, England, the Netherlands, and Sweden (Brewer et al., 1992; Brewer et al., 1995; Dudink, 1994; Verhulst, 1992). A shifted peak in the distribution of Australian soccer professionals paralleling a corresponding change of the cut-off date in Australian soccer in 1988 was also demonstrated. This pattern of results provides strong evidence for the existence of a relative age effect. Month of birth explains from 21% (Brazil) to 81% (Japan) of the variance in the differences between expected and observed number of births. Undoubtedly, relative age is an important factor in whether a young soccer player succeeds or not.

Because physical development is highly correlated with age (Brauer, 1982), previous studies attributed the relative age effect solely to physical advantages of the relatively older players (Baxter-Jones & Helms, 1994; Brewer et al., 1992; Verhulst, 1992). In recent reviews of sociological and psychological factors influencing drop-out rates in youth sport, the relative age effect is not even mentioned (Gould & Petlichkoff, 1988; Skard & Vaglum, 1989; Weiss & Chaumeton, 1992). However, it is likely that psychological manifestations of the effect might be even more important than physical ones, considering the devastating effect of low self-esteem that might be acquired by relatively young children (Harter, 1993). We
propose that future research investigate more closely the affective, cognitive, and motivational effects of a relative age disadvantage. In particular, current theories of achievement motivation should prove to be helpful in revealing the exact mechanisms that finally lead to the withdrawal of relatively young players from sport (cf. Gould & Petlichkoff, 1988; Weiss & Chaumeton, 1992).

For instance, Harter’s (1978) Competence Motivation theory predicts that those high in perceived physical, academic, or social competence will be more likely to continue to participate in their respective activities. Smith’s (1986) cognitive–affective model of stress suggests that in a situation that is characterized by an imbalance between situational demands (e.g., the need to demonstrate ability in a competitive context) and resources (e.g., lack of physical ability), children may perceive sport participation as too stressful and consequently withdraw from the activity. The fact that most children do not perform social comparisons before about age 10 can be easily reconciled with the finding of Barnsley and Thompson (1988) that there are no skewed distributions for age groups under 12 years. Explanations based on physical development, on the other hand, would predict a strong effect already at elementary school level when the relative age difference compared to total age is greatest.

Another possibility (suggested by an anonymous reviewer of this article) is that some kind of a Pygmalion effect (Rosenthal, 1974; Rosenthal & Jacobson, 1968) and thus a self-fulfilling prophecy might also contribute to the effect. Traditionally researched within the context of classroom achievement, the Pygmalion effect predicts that expectancies of student ability trigger a series of verbal and nonverbal interactions that inadvertently control the student’s subsequent achievement behavior. Children profiting most from a relative age advantage are likely to be erroneously perceived as the most talented in their age group. This impression may be stabilized in a self-fulfilling manner if the behaviors of parents, coaches, and peers covary with the initial perception of children’s abilities (cf. Landers & Fine, 1996; Rejeski, Darracott, & Hutslar, 1979). For example, children advantaged by their relative age may receive better coaching, higher competition, and more prestige, resulting in a better development of the older players’ talents.

Future research should attempt to determine the exact point at which a relative age effect begins to operate (cf. Barnsley & Thompson, 1988). Answering this question should help to decide between explanations based on physical as opposed to cognitive, affective, or motivational factors. In this context, it seems worthwhile to conduct longitudinal studies relating drop-out rate to children’s perceived ability, anxiety, intrinsic motivation, self-concept, and self-esteem. (See Alsaker & Olweus, 1993, and Fenzel, 1992, for similar studies pointing out the effect of relative age in school on these variables.)

One may ask whether it is rational to promote children’s participation in organized sport on the one hand, but on the other, to set up a system that systematically reduces the proportions of later-born children in each cohort. What remedies for the problem can be suggested?

One-year or 2-year periods may be too great an age band from which to select squads (Brewer et al., 1995). A shorter 9-month period, as suggested by Boucher and Halliwell (1991), would not only reduce the age difference between the youngest and oldest children but also have the added advantage of constantly cycling the cut-off date throughout the year in 3-month intervals, thereby eliminating a systematic bias against children born late in a fixed competition year. However,
a smaller age band, as well as a rotating cut-off date, might prove difficult to manage on a practical basis due to organizational problems and the lower number of players available in each age group if a shorter competition year applies.

To summarize, the present research suggests that the average child who drops out is born late in the competition year. We therefore predict systematic differences on affective, cognitive, and motivational dimensions between children born early as compared with those born late in the competition year.

References


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