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Article *in* Journal of Sports Sciences · July 2005

DOI: 10.1080/02640410400021310 · Source: PubMed

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Journal of Sports Sciences, June 2005; 23(6): 629 – 636

The relative age effect in youth soccer across Europe

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(Accepted 24 July 2004)

Abstract

The potential asymmetries in the birth-date distributions of youth soccer players across ten European countries (2175 age citations) were considered. First, we examined the birth-dates of players representing national youth teams in international competitions. Second, the birth-dates of players representing professional club teams in international youth tournaments were analysed. Kolmogorov-Smirnov tests were used to assess differences between observed and expected birth-date distributions. Regression analyses were employed to examine the relationship between month of birth and number of players in the different samples. The results showed an over-representation of players born in the first quarter of the selection year (from January to March) for all the national youth selections at the under-15 (U-15), U-16, U-17 and U-18 age categories, as well as for the UEFA U-16 tournaments and Meridian Cup. Players with a greater relative age are more likely to be identified as ‘‘talented’’ because of the likely physical advantages they have over their ‘‘younger’’ peers. Some options for reducing the relative age effect are offered.

Keywords: *Performance, player selection, seasonal variation, talent identification*

Introduction

In most countries, the government invests in education to provide students with appropriate learning facilities, up-to-date study programmes and competent teachers from primary school to university. The desire to provide appropriate education and equal opportunities for successful participation by each and every child regardless of, for example, race, religion or background is a primary concern. To fulfil these objectives, children are grouped by chronological age. Grouping by chronological age is generally achieved by establishing a selection period. In many school systems, a 12-year-old is defined as a child whose twelfth birthday falls during the ‘‘academic year’’, specifically between 1 January and 31 December.

In youth sport competitions, children are also divided according to their chronological age. For example, in 1997 the governing body of soccer, FIFA (Fédération Internationale de Football Association), imposed a start date of 1 January for its selection year for international competitions. The main goal when imposing this selection criterion was to ensure that children's development is age-related and that there is fair competition and an equal chance of success for all.

Unfortunately, as children are separated into age groups there are invariably cognitive, physical and emotional differences between the youngest and the oldest ones (Malina, 1994; Musch & Grondin, 2001; Williams, Davies, Evans, & Ferguson, 1970). The youngest children are those boys or girls who are born far from the cut-off date, while the oldest children are those born close to the cut-off date. As a result, there can be an age difference of almost one year between the oldest and youngest participants within any age group. The relative age effect (also called age-group position effect), which refers to the overall difference in age between individuals within each age group, may result in significant differences in performance (Barnsley, Thompson, & Legault, 1992).

Significant variation in academic and sports performance may arise because of differences in growth and development between those born early and late in the selection year (Rummenich & Rogol, 1995). Although an age difference of less than 12 months may have little relevance for adults, it may be

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ISSN 0264-0414 print/ISSN 1466-447X online
DOI: 10.1080/02640410400021310

significant in children. A 10-year-old child in the 5th percentile is likely to be 1.26 m tall with a body mass of 22 kg, whereas a child in the 95th percentile who is almost 11 years of age is likely to be 1.54 m tall and 49 kg in mass. Consequently, a relatively small 10-year-old child can be approximately 0.2 m shorter and 27 kg lighter than an early maturer with a one-year relative age difference (Tanner, 1978; Tanner & Whitehouse, 1976). A relative age difference of 12 months can therefore result in significant anthropometric variances.

The relative age effect may offer other advantages to those who are born early in the selection year compared with those born later in the year. For example, Vroom (1964) argued that the level of performance achieved by individuals is the product of their capacities and motivation. The intensity of motivation has an impact on the quality of learning and performance because it determines how efficiently the potential capacities are used. A child born at the beginning of the year will, on average, perform better than a peer born at the end of the year. This initial performance advantage is likely to increase intrinsic (observed competence) and extrinsic (appreciation of teachers and parents) motivation to continue involvement in the sport. This increase in motivation, coupled with greater perceived competence, will encourage those born early in the selection year to continue to practise to further improve and refine their skills compared with those born later in the year (Shearer, 1967). To this end, there is some circularity (i.e. a vicious circle) in seasonal birth effects, with those born early in the year having an increasing advantage over those born later in the year (Sharp, 1995).

Another factor that has often been neglected when discussing the relative age effect relates to differences in experience as a function of age (Helsen, Hodges, Van Winckel, & Starkes, 2000b). For example, two children within the same age group may differ quite markedly in their level of soccer experience if one is born in January and the other in December of the same calendar year. This relative lack of experience is another disadvantage for those born far from the cut-off date (see Ward & Williams, 2003; Ward, Hodges, Williams, Starkes, 2004).

A final factor is the manner in which children perceive success and failure in sport. According to Weiner's (1986) attribution theory, children attribute causal explanations to their successes and failures. The affective-emotional reaction to any situation depends on how the result is perceived by the child (i.e. as a success or failure). In addition, it largely depends on the way in which the result is explained in causal terms (internal or external). Children generally feel pride or shame depending on the extent to which they attribute success or failure to themselves personally or to external factors such as luck or injury. The self-image and self-esteem of any child will be affected favourably by success and unfavourably by failure if the cause is perceived to be internally mediated. Since people strive towards a positive self-image, the tendency is to ascribe successes to internal factors and failures to external factors that one has limited control over. Further research is required to identify how the relative age effect impacts upon children's levels of self-esteem and potential to "drop out" of sport. It has already been demonstrated that the relative age effect is correlated with a higher incidence of suicide in school children (Thompson, Barnsley, & Stebelsky, 1991).

Because of differences in relative age across individuals, extraneous factors such as date of birth may skew access to educational opportunities as well as to sport participation and success. It has been shown that excellence in scientific creativity (Holmes, 1995), in university academic performance (e.g. Boddi, Brizzi, Conti, & Gensini, 1996; McManus, 1996) and in sport (Baxter-Jones & Helms, 1994) correlates with birth dates. In terms of academic achievement, it has been shown that the relative age effect clearly persists beyond the end of primary education (Bell & Daniels, 1990) and even has consequences for access to, and success at, university (Azevedo, Pinto-do-O, & Borges, 1995).

In sport, asymmetries in the birth-date distributions of adult professional players and youth squads have been reported (for a review, see Boucher & Mutimer, 1994). In soccer, for example, the relative age effect has been found in both adult players (e.g. Barnsley *et al.*, 1992; Baxter-Jones, 1995; Brewer, Balsom, & Davis, 1995; Dudink, 1994; Helsen, Starkes, & Van Winckel, 2000a; Musch & Hay, 1999; Richardson & Stratton, 1999; Verhulst, 1992) and youth players (e.g. Barnsley, Thompson, & Barnsley, 1985; Baxter-Jones, 1995; Helsen, Starkes, & Van Winckel, 1998b, 2000a; Musch & Hay, 1999). Youth players born early in the selection year, beginning in the 6- to 8-year-old age group, are more likely to be identified as talented by professional teams, to play for national teams and, eventually, to become involved in the sport as a professional. In comparison, players born late in the selection year are more likely to drop out of the sport as early as 12 years of age (Feltz & Petlichkoff, 1983; Helsen, Starkes, & Hodges, 1998a). To explain these findings, researchers have shown that players with a relative age advantage over their playing peers possess significant developmental advantages (i.e. height, weight and strength) that impact on perceived potential and predicted success in sport. Given the importance of these early experiences for the development of sport skills, strong relative age effects in professional players might be a consequence of the early onset of these effects in the youth age categories.

Since talent detection and identification procedures may be biased by these reported differences in relative age, an examination of the specific talents that underlie sports performance is of great importance to youth coaches and researchers. Howe, Davidson and Sloboda (1998) carried out a comprehensive review of the role of talent in music. They examined the relationship between biological correlates of specific abilities on the one hand and their role in musical expertise on the other. Using a multidisciplinary approach, and a detailed analysis of the scientific evidence, they suggested "that differences in early experiences, preferences, opportunities, habits, training and practice are the real determinants of excellence" (p. 2). Howe *et al.* (1998) concluded that while talent is genetically transmitted and hence at least partly innate, it is also domain-specific and its full effects may not be evident at an early stage. They suggested, however, that there will be some advance indications that allow trained people to identify the presence of talent before exceptional levels of mature performance have been demonstrated and that these early indications provide a basis for predicting who is likely to excel. This operational definition of talented individuals has led researchers to try and capture the intuitive assessment of talent in a sport context. At present, it is difficult to support the notion that expertise in sport can be predicted on the basis of any specific measure of talent (Williams & Reilly, 2000). However, it is rare to meet a coach who feels he or she is unable to "see" talent. An important question in this regard is what criteria coaches use to discover talented youth players and if there is any evidence to suggest that their "vision" may be biased by temporary differences in growth and maturation.

Since most research has only examined male national youth selections within a particular country, in this study the relative age effect is considered in male and female national youth selections across ten European countries. In addition, to study further the extent of this selection bias, we examined whether the relative age effect is present in the youth teams of professional soccer clubs across Europe. To achieve this latter aim, we analysed the birth-date distributions of professional teams that participated in two major U-12 and U-14 international youth tournaments.

Methods

Participants

Table I highlights the samples of international youth selections that were examined. First, the birth-date distributions of the under-15 (U-15), under-16 (U-16), under- 17 (U-17) and under-18 (U-18) national youth selections for the 1999 – 2000 season for Belgium, Denmark, England, France, Germany, Italy, The Netherlands, Portugal, Spain and Sweden were examined (for France, Spain and Sweden we could only obtain the data of the official U-16 and U-18 national youth selections performing in the UEFA competitions). Second, the birth-date distributions for the national youth squads performing at major international youth tournaments for the under-16 (U-16), under-18 (U-18), under-21 (U-21) and the women's under-18 (U-18) age groups, and the Meridian Cup championship organized by the European governing soccer body (UEFA, Union des Associations Européennes de Football), were analysed. Finally, we examined the birth-date distributions of 16 professional teams that participated in an under-14 (U-14) international tournament and those of 32 club teams that were involved in an under-12 (U-12) European international tournament, both held in Belgium during 2000.

Table I. Number of players for each of the three samples.

National selections	Number of players
Belgium	99
Denmark	90
England	94
France[1]	41
Germany	103
Italy	77
Spain[1]	50
Sweden[1]	36
The Netherlands	101
Portugal	72
Sub-total	763
UEFA tournaments (national selections)	
UEFA U-16	288
UEFA U-18	144
UEFA U-21	159
UEFA women's U-18	72
Meridian Cup	72
Sub-total	735
International youth tournaments (club teams)	
Sub-total	677
TOTAL	2175

Procedures

The three age samples of youth players were grouped per competitive year according to month of birth. For consistency of recording, the first month of the selection year was "month 1" (January), while "month 12" represents the last month of the selection period (December). The observed birth-date distributions of each of the samples were calculated per month. The expected birth-date distributions were recorded from the representative birth-dates of children in Belgium. Similar birth-date distributions are apparent across the participating European countries (Cowgill, 1966; Johnson, Ann, & Palan, 1975; Rosenberg, 1966). Kolmogorov-Smirnov one-sample tests (Siegel & Castellan, 1988) were used to assess differences between the observed and expected birth-date distributions. In line with previous studies (Helsen et al., 1998a, 2000a,b), regression analyses were used to examine the relationship between the number of players per age category for each sample and the corresponding month of birth (starting with month 1 and ending with month 12).

Results

The birth-date distributions for the U-15, U-16, U-17 and U-18 national selections for ten European countries, together with the results of the Kolmogorov-Smirnov tests, are presented in Table II. Significant effects were found for Belgium, Denmark, England, France, Germany, Italy, The Netherlands, Portugal, Spain and Sweden. Subsequent linear regression analyses showed a significant decreasing trend for Belgium ($r = -0.93$, $P < 0.0001$), Denmark ($r = -0.74$, $P = 0.006$), England ($r = -0.67$, $P = 0.016$), Germany ($r = -0.92$, $P < 0.0001$), Italy ($r = -0.89$, $P < 0.0001$), The Netherlands ($r = -0.56$, $P = 0.058$) and Portugal ($r = -0.81$, $P < 0.001$).

The birth-date distributions per age category for the UEFA international tournaments are presented in Table III. Significant effects were obtained using Kolmogorov-Smirnov tests for the U-16, U-18 and the Meridian Cup teams. Subsequent regression analyses showed a clear relationship between month of birth and number of participants for the U-16 ($r = -0.90$, $P < 0.0001$), U-18 ($r = -0.84$, $P = 0.0007$) and the Meridian Cup ($r = -0.81$, $P = 0.0016$) teams. The results were not significant for the men's U-21 group or women's U-18 category

Table II. Birth-date distributions of the U 15, U 16, U 17 and U-18 selections per country.

Team	Month of birth												Kolmogorov-Smirnov test
	1	2	3	4	5	6	7	8	9	10	11	12	
Belgium	15	10	12	13	9	10	9	6	5	3	3	4	$P < 0.01$
	$N = 37$ (37.37%)									$N = 10$ (10.10%)			
Denmark	14	10	9	4	15	10	7	7	6	6	0	2	$P < 0.01$
	$N = 33$ (36.67%)									$N = 8$ (8.89%)			
England	21	15	11	5	5	3	4	6	8	8	5	3	$P < 0.01$
	$N = 47$ (50.00%)									$N = 16$ (17.02%)			
France[a]	9	3	6	5	5	3	4	0	0	4	1	1	$P < 0.01$
	$N = 18$ (43.90%)									$N = 6$ (14.63%)			
Germany	18	17	17	6	13	7	9	7	5	2	2	0	$P < 0.01$
	$N = 52$ (50.49%)									$N = 4$ (3.89%)			
Italy	14	12	10	7	6	5	6	9	5	1	0	2	$P < 0.01$
	$N = 36$ (46.75%)									$N = 3$ (3.90%)			
The Netherlands	14	15	11	6	8	7	1	12	14	6	5	2	$P < 0.05$
	$N = 14$ (36.84%)									$N = 6$ (15.79%)			
Portugal	8	15	10	13	9	3	1	5	3	2	3	0	$P < 0.01$
	$N = 33$ (45.83%)									$N = 5$ (6.94%)			
Spain[a]	8	4	6	11	7	4	4	1	0	2	2	1	$P < 0.01$
	$N = 18$ (36.00%)									$N = 5$ (10.00%)			
Sweden[a]	6	8	3	5	3	3	1	3	3	1	0	0	$P < 0.05$
	$N = 17$ (47.22%)									$N = 1$ (2.78%)			
TOTAL	$N = 331$ (43.38%)									$N = 71$ (9.31%)			$P < 0.01$

[a] For France, Spain and Sweden, we could only obtain the data for the official U-16 and U-18 national youth selections performing in the UEFA competitions.

Table III. Birth-date distributions per UEFA tournament.

Team	Month of birth												Kolmogorov-Smirnov test
	1	2	3	4	5	6	7	8	9	10	11	12	
UEFA U-16	60	42	39	27	30	14	15	15	24	15	4	3	$P < 0.01$
	$N = 141$ (48.96%)									$N = 22$ (7.64%)			
UEFA U-18	15	13	15	16	15	13	9	13	9	9	8	9	$P < 0.10$
	$N = 43$ (29.86%)									$N = 26$ (18.06%)			
UEFA U-21	19	8	17	13	16	6	14	14	11	18	10	13	$P < 0.10$
	$N = 44$ (27.67%)									$N = 41$ (25.79%)			
UEFA women U-18	12	5	5	9	10	7	2	3	7	1	5	6	$P < 0.10$
	$N = 22$ (30.56%)									$N = 12$ (16.67%)			
Meridian Cup	11	16	9	5	6	3	5	5	3	4	4	1	$P < 0.01$
	$N = 36$ (50.00%)									N = 9 (12.51%)			
TOTAL	$N = 286$ (45.61%)									$N = 110$ (17.54%)			$P < 0.01$

($r = -0.16$, $P = 0.63$; $r = -0.51$, $P = 0.09$, respectively).

The birth-date distributions are shown for those club teams who participated in the U-12 and U-14 international youth tournaments in Table IV. Both Kolmogorov-Smirnov tests and linear regression analyses provided significant results, highlighting an over-representation of players born in the first quarter of the year and a decreasing number of players born in the subsequent quarters ($r = -0.86$, $P = 0.0003$).

Discussion

In the educational system and the organization of youth sport competition, children are divided into categories based on their chronological age to provide equal opportunities for participation and success. Although it has been shown comprehensively within academic environments that grouping children by chronological age results in strong relative age effects, studies examining the consequences of the relative age effect in youth sports in general, and soccer in particular, are less established, mainly because researchers have focused on a single target group of male players (Helsen *et al.*, 2000a).

When comparing data from educational settings with those gathered within the sport domain, it should be noted that attendance at school is compulsory whereas an individual's decision to participate in sport is a voluntary one. As a result, the tendency for children to drop out of school is reduced, ensuring that children born late in the selection year have the opportunity to catch up and even exceed the initial academic performance displayed by those born early in the school year (see Hauck & Finch, 1993; May & Welch, 1986). In contrast, procedures in soccer talent detection and identification exist for players as young as 6–8 years of age. According to Malina (1999), these selection programmes have several limitations. Most notably, such programmes are elitist and exclusionary in nature, with the risk that they are primarily aimed at achieving short-term success as opposed to focusing on the social and physical development of each player. There is, for example, limited knowledge about how those who are not selected for progression at these early ages cope with rejection and the underlying feelings of failure. The talent selection procedures employed in many sports also tend to discriminate in favour of players who are born early in the selection year – typically those who are physically stronger and who also profit from other advantages associated with the relative age effect (e.g. more experience) – rather than those who are born late in the selection year.

The aim of this study was to determine the extent of the relative age effect in male and female national youth selections across ten different European leagues. It was predicted that the relative age effect would have a clear impact on selection procedures in favour of those born early in the selection year. Players who were "older" and potentially more physically developed were expected to be over-represented in each of the age categories and playing samples examined. The relative age effect in the youth teams of professional clubs was also examined. It was envisaged that in the professional clubs the talent detection and identification procedures would be particularly biased towards those born early in the selection year.

Table IV. Birth-date distributions of the U-12 and U-14 selections of club teams.

	Month of birth												
	1	2	3	4	5	6	7	8	9	10	11	12	Kolmogorov-Smirnov test
U-12	75	68	78	81	45	61	54	55	52	43	28	37	$P < 0.01$
U-14													
TOTAL	$N = 221$ (32.64%)									$N = 108$ (15.95%)			

A clear relative age effect was found for all the national youth selections in the U-15, U-16, U-17 and U-18 age categories, as well as for the UEFA U-16 tournaments and the Meridian Cup. A less pronounced effect ($P < 0.10$) was found for the men's teams in the UEFA U-18 and U-21 tournaments and in the women's U-18 teams. The absence of a relative age effect in these latter groups of players is in line with the findings of Helsen *et al.* (2000a), who showed that there was no difference in the birth-date distributions of 16- to 18-year-old players before and after the change in cut-off date from August to January. The absence of clear differences in these older age groups may be because players born in the first and second quarter of the new selection year (January to July) were initially those born within the third and fourth quarters in the "old" selection year. That is, players who were exposed to the latter selection criteria may already have dropped out of the sport by the time they reached 16–18 years of age. Regarding the UEFA women's U-18 squads, it is well known that girls mature earlier than boys (Malina, 1994). At 18 years of age, most of the female players are fully mature physically, and consequently the relative age differences are much less pronounced in this age group. In addition, it may be that the technical component of soccer is of greater importance in the women's compared with the men's game, and consequently it may be more appropriate to select female players who are technically rather than physically impressive. Although these ideas are in line with the findings of Giacomini (1999), who examined the birth-date distribution of the top 100 female tennis players, it should be recognized that the sample of female players in our study was rather limited (72 age citations). Further research is needed to explore fully the prevalence of the relative age effect in female youth soccer players.

As far as the international youth tournaments for club teams are concerned, there was also an over-representation of players born in the first quarter of the selection year. Clearly, the consequences of the relative age effect are present in competitions involving youth teams from professional clubs to the same extent as in competitions that are organized for national teams.

These findings have significant implications for those involved in the talent detection and identification process. If players are selected because of their physical characteristics, this may be problematic after maturation when this advantage is no longer present and technically ability may be the overriding factor in achieving success. Unfortunately, selections are based too often on physical size, and consequently a significant amount of talent may be lost to the sport. Players who are less developed physically because of their younger relative age, but who are talented or more technically gifted, are clearly not selected for continued access to high-level coaching compared with those born early in the selection year. These players may be denied access to professional training and the opportunity to fulfil their potential. In the long term, this bias results in a devalued selection policy, and in a much higher proportion of players who are born later in the year dropping out of the sport compared with those born earlier in the year (Helsen *et al.*, 2000a). In addition, in periods of rapid growth, skeletal and muscular developments result in significant changes in coordination. These changes and the higher intensity associated with training and matches at the start of a new season, when children may be participating in an older age group for the first time, can result in a higher incidence of injuries in players born in the final two quarters of the selection year. Although it is beyond the scope of this study, we speculate that repeated injuries could be another reason for dropping out. It would be interesting to explore trends for changes in age-bias with time by monitoring the same squad(s) for a number of years in order to examine longitudinally the different reasons for eventually dropping out.

Three explanations have been proposed to account for the relative age effect (Helsen *et al.*, 1998a). First, current talent detection and identification procedures are heavily biased towards a child's physical attributes rather than his or her technical skill. Second, the organization of youth competitions in 24-month age bands places greater significance on the importance of physical characteristics in player selection. Finally, players are exposed to high-level competition at a much earlier age in soccer than in other sports. The first of these propositions certainly holds true across Europe. There is increasing emphasis on clubs to detect players and nurture and guide them through the talent development process. To achieve this aim, clubs need to identify successfully at an early age those players who are likely to be star performers in the future. The tendency at present, as clearly illustrated by the current findings, is to select players who are advanced in chronological age and physical development. The difficulty is how to keep those players who are physically disadvantaged involved in the sport so that after maturation they have the opportunity to benefit from any advantage that they may have in technical ability. The relative age differences are much less pronounced in female soccer players, presumably due to the fact that girls mature at an earlier age. Asymmetries in the birth-date distributions of female soccer players are therefore less apparent.

In addition to the apparent differences in physical maturation as a result of the relative age effect, those born early in the year may also be more psychologically mature than their counterparts. Players born earlier in the selection year will probably experience more success than those born later in the year because of their physical advantage (Helsen *et al.*, 2000b). This factor may increase motivation and encourage those born early in the year to continue to practise in an attempt to achieve further success. The opposite process might be apparent in those born later in the year, potentially reducing their motivation to continue to participate in the sport. Coaches are likely to choose players who appear the most motivated, which may also increase the difference in number between "older" and "younger" players. Another factor that is often forgotten when examining the relative age effect is the experience of the players. Players born in January are not only older than players born in December of the same year, but they are also likely to have accumulated more experience as a result of earlier exposure to practice and competition (Helsen *et al*, 1998b; Ward *et al.*, 2004). This earlier exposure to practice and match-play may provide players with a significant advantage in relation to the development of technical and game intelligence skills (Ward & Williams, 2003; Williams, 2000).

Solutions

Several solutions to the relative age effect have been proposed in the literature. First, a yearly rotation in cut-off date might work (Boucher & Halliwell, 1991), since all players would then experience the advantage of a higher relative age at some point in their soccer career. A second possible solution is to create more age categories with a smaller bandwidth (e.g. one year instead of two). This change would result in a smaller relative age difference and fewer physical differences between players within any specific age category (Barnsley & Thompson, 1988). A third solution would be to change the mentality of youth team coaches (Barnsley & Thompson, 1988; Helsen *et al.*, 2000a,b). Coaches should pay more attention to technical and tactical skills when selecting players as opposed to an over-reliance on physical characteristics such as height. In a similar vein, coaches should be encouraged to change their philosophical approach to instruction. The statement that "winning isn't everything, but the only thing" currently represents the strategic thinking of many youth coaches. Coaches should find a better balance between short-term success and a more task- or process-oriented approach to instruction. Clearly, "winning" does matter at the elite level in soccer. In this sense, the players must be exposed to such a reality at some stage during their progression to the elite level. This is perhaps especially important when selecting national youth teams. In the professional club teams, player development should hopefully be viewed as a more long-term process spanning a 10-year period and beyond. In any case, it would be big step forward if the philosophy of future coaches in general, and of those who are involved in the professional clubs in particular, may be more guided by the premise that "there is more to coaching than just winning".

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