In search of the Optimal Triple Jump Ratios: Trial and Error

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Unlike the long jumper who exerts a maximum effort in order to gain maximum distance, the triple jumper gains maximum distance by distributing his or her effort across the three phases. Triple jumpers have long known from experience that in spite of distributing their effort, they still lose horizontal momentum during each takeoff. Their experiences have been verified by numerous triple jump studies (Bober, 1974; Milburn, 1979; Fukashiro et al., 1981; Hay and Miller, 1985; Susanka et al.; 1987; Larkins, 1987). In an attempt to diminish this problem, triple jumpers, with the help of their coaches, have searched for techniques that best allow them to conserve horizontal momentum and thereby achieve maximum distance.

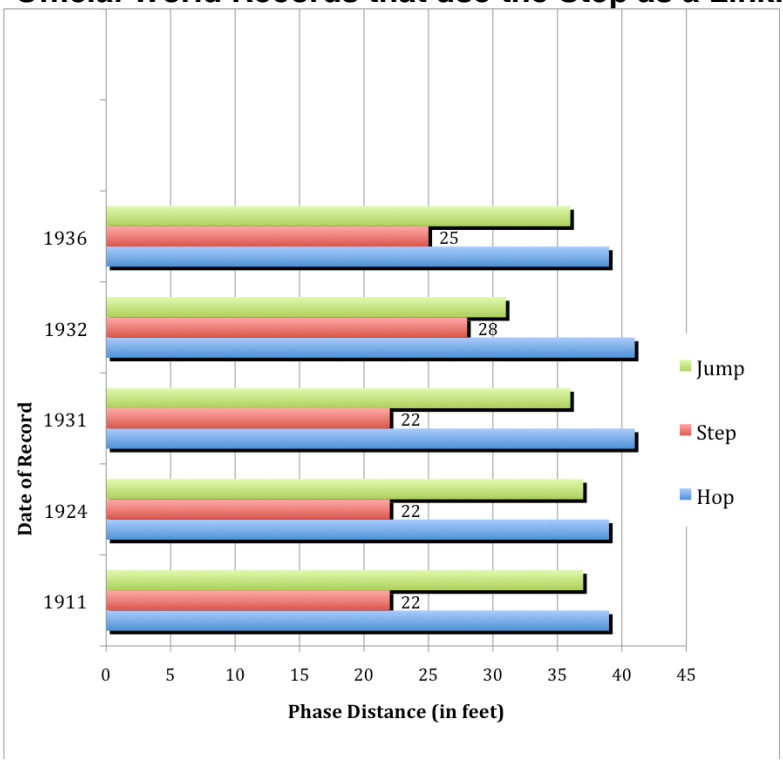
Researchers have also shown that the takeoff velocities are directly related to the phase distances. Armed with this piece of information, coaches have realized that the phase distances can tell them a great deal about how the jumper attempted to conserve horizontal momentum. They also realized that, unlike most of the other components of triple jump technique, phase distances are easy to manipulate. The jumper, in other words, can easily put more or less emphasis on any one phase, dependent upon his or her strategy for conserving horizontal momentum. Because there are three phases, however, numerous strategies exist for distributing one's effort, and this is the crux of the problem. With each performance, then, the triple jumper faces the difficult problem of finding the best or optimal apportionment.

Because of the lack of a methodical solution to this problem, jumpers have attempted to improve their performance by experimenting with various phase apportionments. In the past, as they experimented, they began to wonder whether there was a particular apportionment that was better than any other. This question has led to a search for the best or optimal apportionment. Clearly, their search, however, has not been systematic. As Tan (1959, 1970) has pointed out, the search has moved somewhat like a pendulum, swinging from one extreme in technique to another. The following study, then, is an effort to trace the evolution of triple jump technique, focusing on how the current philosophy of phase apportionment has evolved through trial and error.

The Step Phase as a Link

At the turn of the century, jumpers appeared to view the triple jump as three separate jumps; they emphasized the hop and jump phases while the step phase was used only as a link. Dan Ahearne of the U.S.A. employed phase distances of 20' - 11'3" - 19'8" (Tan, 1959, p 22) in order to establish the first official world record of 50'11" in 1911. In 1924, Anthony Winter of Australia used nearly an identical apportionment in order to win the Paris Olympic Games and establish a new world record of 50’11 ¾”. This emphasis on both the hop and the jump phases while using the *Step Phase as a Link* was probably the earliest noticeable trend in triple jump technique. Figure 1 shows that this trend was prevalent until the late 1930’s.

Figure 1 -- The Step Phase as a Link
Ratios for Official World Records that use the Step as a Linking Phase



The Big Hop Style / Russian Style

The Japanese, who emerged as a dominant force in triple jumping during the late 1920's, also used the step as a linking phase. However, their style was also characterized by an extremely long hop-phase, hence, the origin of *The Big Hop Style*. Even though they tended to be small in stature and often lacked great speed, they nonetheless frequently hopped over 21 feet. In 1931, when Mikio Oda jumped 51'1 3/8" his phase distances were 21'4" - 11'6" - 18'3". His hop distance accounted for an incredible 41% of the total distance, whereas his step distance accounted for only 22%. The Japanese used the Big Hop Style to dominate three consecutive Olympic Games--Mikio Oda in 1928, Chuhei Numbu in 1932, and Naoto Tajima in 1936.

Because of the absence of major competitions during World War II as well as the cancellation of the 1940 and 1944 Olympic Games, the general development of triple jump technique was delayed. By the time major competitions resumed in the late 1940's, the top jumpers had cut back on their hop distance and increased their step distance. This shift is perhaps partly an expression of the emerging "balanced philosophy" which will be discussed in detail later. Suffice it to say for now that jumpers such as H. Masegawa of Japan who jumped 51' 3" in 1948 and Adhemar da Silva, five time world record holder and 1952 and 1956 Olympic Champion from Brazil, both used this style.

In 1950, da Silva set his first world record using a style of jumping that did not emphasize one phase over another. This style would later be called the Balanced Style. By 1952, however, da Silva's style changed; he cut back on his step (though not to the extent of the Japanese big hoppers) and put more emphasis on the hop phase. This new shift in the Big Hop Style helped him to win the 1952 and 1956 Olympic Games and establish world records in 1952 and 1955. For his record jump in 1952, for example, his

percentage pattern was 38% : 28% : 33% -- clearly a return to greater reliance on the hop phase. This shift may have reflected the philosophy of Dietrich Gerner, who is reported to have coached da Silva for several years. Gerner believed that the best percentage pattern was 37% : 30% : 33% (Doherty, 1976, p 198), which is very close to da Silva's actual performance.

In 1953, Leonid Shcherbakov of the Soviet Union usurped the world triple jump record from da Silva with a leap of 53'2 3/4". At that time Shcherbakov's style was very similar to da Silva's and for his record jump he used a hop contribution of over 37%. Shcherbakov's reign was short lived, however, as da Silva recaptured the record in 1955 when he jumped 54'4".

In 1958, the Soviet triple jumpers finally gained dominance when Olyeg Ryakhovskiy broke da Silva's record with a jump of 54'5 1/4". In order to achieve that distance, he also relied heavily on the hop phase using a percentage pattern of 39% : 30% : 31%. One year later Oleg Fydoseyev, another Soviet triple jumper, increased that record to 54'9 1/2" using a percentage pattern of 39% : 29% : 32%. Shcherbakov, Ryakhovskiy, Fyodoseyev, Kreer, and Saneyev were all Russian triple jumpers who brought pride and consistent notoriety to U.S.S.R. track (E. Bullard and L. Knuth, 1977, p 229), and who moved the world's triple jump performance to a higher level. Their reliance of a hop contribution of 39% gave the style pendulum a significant thrust back toward the Japanese's Big Hop Style. In honor of the Soviets' accomplishments, performances in which the hop distance is greater than the jump distance are usually given the title the *Russian Style*. The major difference between the Japanese's Big Hop Style and the Soviet's Russian Style is that the Russian Style relies more on the step phase and less on the hop phase than the Japanese's Big Hop Style.

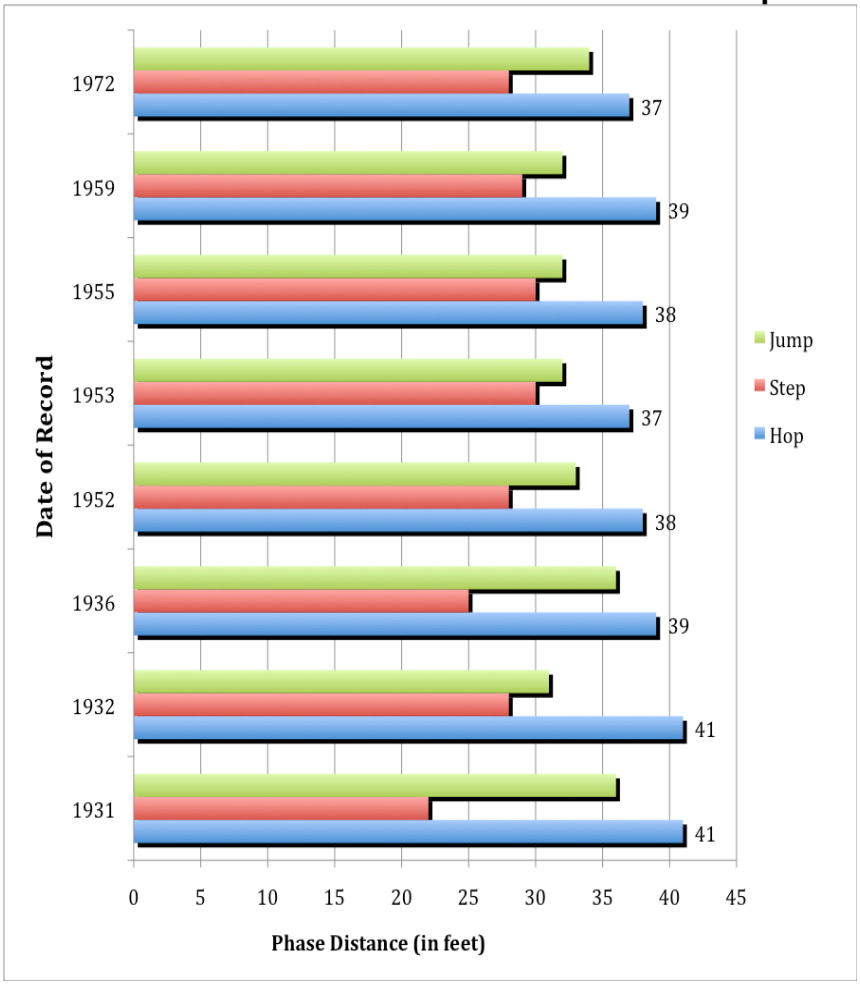
Like their Japanese predecessors, the Soviet triple jumpers in the late 1950s and 1960s lacked great speed, and instead relied on strong springy legs in order to bound from one takeoff to the next. This bounding technique tended to produce a long hop, the trade mark of the Russian Style. Furthermore, some coaches and researchers believe that this style was a direct result of the double arm swing used by many of the Soviet triple jumpers during each takeoff. It should be noted, however, that it has never been reported that the great Japanese big hopper ever used a double arm swing.

Probably the most famous Russian Style jumper was Viktor Saneyev of the Soviet Union. He single handedly established the Soviet Union as the world's perennial triple jump power by winning three consecutive Olympic Championships, 1964, 1968, and 1972. He captured the 1968 Olympic title in Mexico City with a world record jump of 57' 3/4". In 1972, he recaptured the world record with a jump of 57'2 3/4". He achieved these distances by using a double arm swing during each takeoff and a hop percentage in the range of 37% to 38% (Kreer, 1973). In setting his 1968 world record, however, it is reported that he used phase distances of 36% : 29% : 35% : which more closely resembles the Balanced Style rather than the Russian Style. The percentage pattern for his 1972 record, however, more closely resembled the Russian Style (see Table 1). As Figure 2 shows, no world record has been set using this style since Saneyev's 1972 world record.

Of the twelve finalists in the 1984 Los Angeles Olympic Games, Hay and Miller (1985) found that seven of the twelve triple jump finalists used the Russian Style. The average percentage patterns for these Russian Style jumpers was 36.4% : 29.5% : 34.2%. Hay and Miller found that "none of the seven, however, recorded ratios in which the hop phase was as overwhelmingly dominant as suggested by McNab for the Russian technique." The longest recorded hop was 36.6% by Agbekau of Nigeria who

placed seventh (Ecker, 1987). Given Hay's and Miller's observation of the seven 1984 finalists studied, this study would describe them as using the Balanced Style.

Figure 2 -- The Big Hop Style / Russian Style
Phase Ratios for Official World Records that relied the hop contribution



Over the years, coaches have endorsed various percentage patterns that emphasize the hop phase. Tan (1959, p 19) recommended 37% : 30% : 33%. McNab (1977 p 11) suggested the same ratios for mature jumpers. The USSR National Triple Jump Coach, Yuri Verhoshanski, is said to have recommended 37.8% : 28.9% : 33.3% (Doherty, 1976, p 198). A hop contribution of 37%, however, is relatively small in comparison to the Japanese big hoppers.

Many of the coaches and researchers who advocate emphasizing the hop phase believe that this style is best suited for mature jumpers. The logic behind this philosophy runs, in brief, as follows: if the jumper is strong enough and mature enough to be able to rebound from a long hop-phase, he or she will have enough momentum left to achieve long step and jump phases as well (Doherty, 1976). Regardless of the maturity of the athlete, however, composition of the event and physical demands of sequential takeoffs and landings will always limit the effective distance of the hop phase.

Table 1: Phase Ratios for Official World Record Performances in the Triple Jump

Athlete	Year	Total distance Ft(m)	Hop Ratio *(%)*	Step Ratio *(%)*	Jump Ratio *(%)*
Dan Ahearne (USA)	1911	50'11"(15.52)	39	22	37
Nick Winter (Australia)	1924	50'11 3/4"(15.52)	39	22	37
Mikio Oda (Japan)	1931	51'2 3/8"(15.58)	41	22	36
Chuhei Nambu (Japan)	1932	51'7" (15.72)	41	28	31
Jack Metcalfe (Australia)	1935	51'9 3/8"(15.78)	34	26	39
Naoto Tajima (Japan)	1936	52'5 7/8"(16.00)	39	25	36
Adhemar da Silva (Brazil)	1950	52'5 7/8"(16.00)	34	30	35
Adhemar da Silva (Brazil)	1951	52'6 1/4"(16.01)			
Adhemar da Silva (Brazil)	1952	52'10 1/2"(16.12)			
Adhemar da Silva (Brazil)	1952	53'2 1/2"(16.22)	38	28	33
Leonid Sherbakov (USSR)	1953	53'7 3/4"(16.23)	37	30	32
Adhemar da Silva (Brazil)	1955	54'4"(16.56)	38	30	32
Olyeg Ryakhovskiy) (USSR)	1958	54' 5 1/4"(16.59)	39	30	31
Oleg Fydoseyev (USSR)	1959	54'9 1/2"(16.70)	39	29	32
Josef Schmidt (Poland)	1960	55'10 1/4"(17.03)	35	29	35
Giuseppe Gentile (Italy)	1968	56'1"(17.10)			
Giuseppe Gentile (Italy)	1968	56'6"(17.22)nw			
Viktor Saneyev (USSR)	1968	56'6"(17.23)nw			
Nelson Prudcncio (Barzil)	1968	56'8"(17.27)nw			
Viktor Saneyev (USSR)	1968	57' 3/4"(17.39)	36	29	35
Pedro Perez (Cuba)	1971	57' 3/4"(17.40)			
Viktor Saneyev (USSR)	1972	57'7 3/4"(17.44)	37	28	34
Joao Carlos de Oliveira (Brazil)	1975	58'8 1/4"(17.89)	34	30	36
Willie Banks (USA)	1985	58'11 1/2"(17.97)	35	28	37
Jonathan Edwards (England)	1995	60'5 1/2"(18.43m)w	35.3	30.4	34.3
Jonathan Edwards	1995	60'0"(18.29m)			

w = wind aided jump non-WR
nw = non-winning: performance
Note. Because most of the ratios were not precisely measured, they should not be treated as precise values but as very good estimates.
Blanks indicate no ratios reported

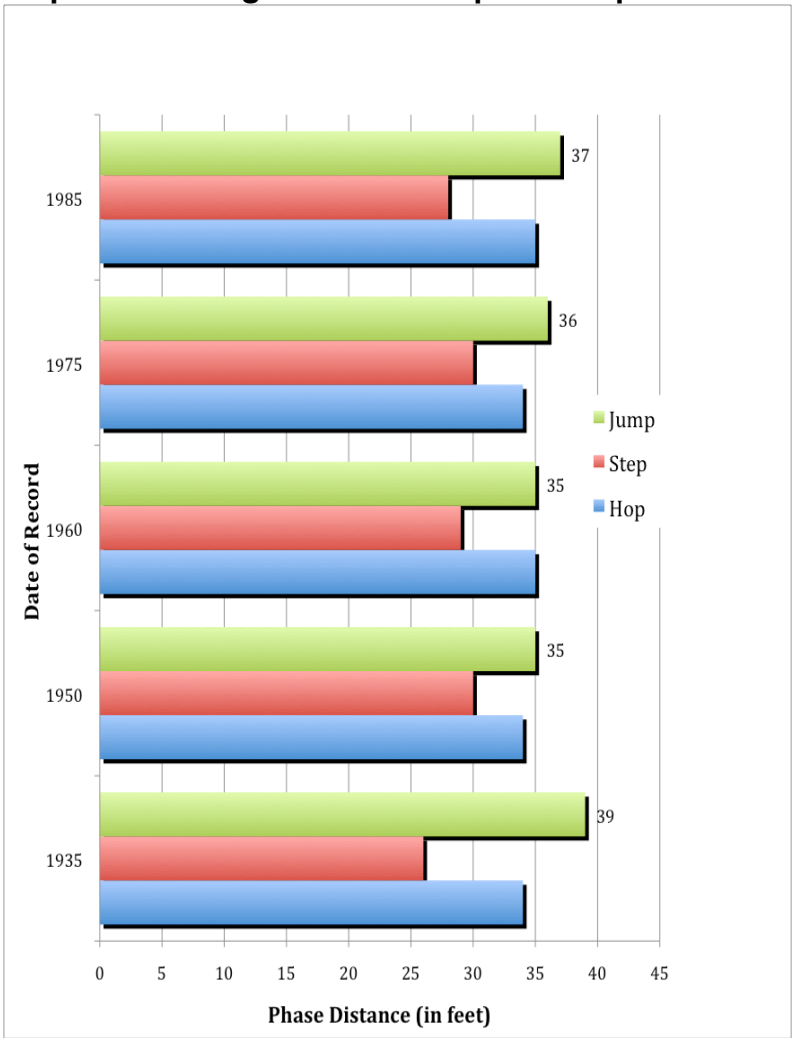
The Big Jump Style/ The Polish Style

After the initial introduction of the Big Hop Style by the Japanese in the late 1920's, the style pendulum abruptly swung to the other extreme - the *Big Jump Style*. In 1935, Australian Jack Metcalfe temporarily toppled the Japanese from their dominance when he established a world record of 51' 9 3/4". In doing so he deviated from the Japanese's style by placing his emphasis on the jump phase. Tan (1959, p 22) reported that for Metcalfe's record breaking performance, his hop, step, and jump distances were 18' - 13'6" - 20'3 3/4". Metcalfe's apportionment showed that other strategies besides the Big Hop Style could be used to break world records. One year later, however, the Japanese big hoppers regained dominance when Naoto Tajima used phase distances of 20'4" - 13'1" - 19' 7/8" in order to win the 1936 Berlin Olympics and establish a new world record of 52'5 7/8".

Because of the absence of major competitions during World War II the full potential of the Big Jump Style was never fully developed. In fact, this style virtually disappeared from the international scene until the 1980's. Phase data exist for only 18 records (see Table 1), and out of those 18 records, only five of these were established using a jump distance that was longer than the hop distance (see Figure 3). Two of those five records, da Silva in 1950 and Josef Schmidt in 1960, did use a jump distance that was longer than their hop distance; however, there was only a one percent difference or less between their hop and jump distances. From available information, then, it appears that a "true" Big Jump Style has rarely been the vehicle to record breaking performances.

A subcategory of the Big Jump Style is the *Polish Style*, in honor of Polish jumper Josef Schmidt. Schmidt emphasized the jump phase to help him win the 1960 and 1964 Olympic Games as well as establish a world record in 1960. Again, even though his jump phase did not dominate his performance, he did place more emphasis on the jump phase than previous Olympians and record holders, and therefore his name has been closely associated with long jump-phases. As a tribute to his success, today any performance in which the jump distance is longer than the hop distance is usually called the Polish Style. Most influential in bestowing this title on Schmidt, however, was the statement made by Mikio Oda (1964), 1928 Olympic Champion and later Japanese triple jump coach, who claimed, "The Soviet and Silva methods aim at the long hop, while the Polish method aims at the big Jump (p 280)."

Figure 3 -- The Big Jump Style / Polish Style
Phase Ratios for Official World Records that use a jump distance equal to or longer than the hop and step distance



In contrast to the Russian Style jumpers, Schmidt possessed great speed and utilized it effectively. He kept his trajectory low during the hop and step flights, which seemed to allow him to maintain momentum throughout the performance. He was then able to place his emphasis on the jump phase (Doherty, 1976). Because of the low trajectories of the first two flight phases, it is easy to understand why this style is also referred to as the "Shallow" or "Flat" Method.

McNab (1977, p 11) characterized the Polish Style as having a percentage pattern of 35% : 29% : 36%. He suggested that this apportionment might best be used during the early years of a jumper's career. The German researcher, Toni Nett (1961), however, was probably the first to derive the percentage pattern for the Polish Style. He averaged 30 jumps by Schmidt and 8 jumps by Einarsson, Iceland's runner-up in the 1956 Olympic Games, and found that both jumpers used approximately the same pattern, 35% : 30% : 35%. He believed that this style was economical. He stated that when the hop contribution was greater than 38%, the horizontal takeoff velocity decreased considerably, and when the hop contribution was between 20% and 30%, there was no decrease in the horizontal velocity, but the athlete could not jump so far. Because of Nett's influence, this percentage pattern has most often been cited as the optimal apportionment.

In spite of Schmidt's outstanding performances in the 1960's and the endorsement of the Polish Style by the prominent researcher Toni Nett, the popularity of the Polish Style faded in the 1970's in the glow of the accomplishments of Russian Style jumper Viktor Saneyev.

In the 1980's, however, the Polish Style regained visibility primarily due to the performances of one jumper, Willie Banks of the United States. In their study of the 1984 Olympic Games in Los Angeles, Hay and Miller (1985) found that five of the finalist produced longer jump distances than hop distances. They noted that three of the five Polish Style jumpers used a percentage pattern close to the 35% : 29% : 36% pattern suggested by McNab (1977). Bouschen and Banks, however, who placed fourth and fifth respectively, emphasized the jump phase more than the others. Their percentage patterns were 32.7% : 30.5% : 36.7% and 35.6% : 26.8% : 37.8%, respectively.

During the 1985 TAC Championships in Indianapolis, Willie Banks established a new world record with a distance of 58 11 1/2". Miller and Hay (1986) reported that during that performance, Banks' jump phase accounted for the greatest percentage (37.3%) of the effective distance. "His distance was the largest ever recorded for a world record and exceeded the nearest value (de Oliveira's 6.43 m) by 0.26 m. Thus, it was the distance of the jump phase that set Bank's world record apart from those of his predecessors (p 276)." It is interesting to note that Banks' 37.3% jump contribution reveals a style that is closer to the early Big Jump Style than it is to the more “balanced” Polish Style.

The Big Step Style

As one might expect, after experimenting with the big hop style and the big jump style, it was inevitable that some jumpers would experiment by lengthening the step phase. As early as 1924, L. Brunetto used phase distances of 20'4" - 15’7" -14'8 1/4" to jump 50' 7 1/8" (Tan, 1959, p 20). This distance placed him second in the 1924 Paris Olympics. Tan also reported that in 1932 Numbu jumped 51’7" using phase distances of 21' - 14'6" - 16'2". The step phase of these two performances were still rather short by today's standards, but they demonstrated that a step distance of over fourteen feet could be used without detracting from the total distance (Doherty, 1976).

Leonid Shcherbakov of the USSR, however, carried the big step style to extremes when in 1950 he used phase distances of 18'6" - 17'3" - 15'9" in order to jump 51'6 1/8" (Tan, 1970, p 205). Seventeen years later when asked whether Shcherbakov contributed anything to triple jump technique, Polish triple jump coach and authority Thaddeus Starszyinsky replied, "Not really. He was a 'natural' jumper of great strength, but he only did a hop and step and then 'died' into the pit. Shcherbakov led many jumpers astray and led to all sorts of mixed techniques (McNab, 1967, p 900)." In all fairness to Shcherbakov, however, it should be noted that three years later, he de-emphasized the step phase in order to jump a world record distance of 53'2 1/2". His phase distances for his record breaking jump were 19'8 1/2" - 16'3 1/2" - 17'2 1/2".

At the same time Shcherbakov was experimenting with the Big Step Style, Adhemar da Silva was experimenting with a different style. Instead of over emphasizing the step phase, he kept it in balance with the other two phases, which helped him to conserve enough horizontal momentum so that he didn't "die into the pit." By the 1960's most of the elite triple jumpers were following da Silva's example.

In fact, from the early 1900's and on through the 1970's, the step phase had evolved from being merely a link between the hop and jump phases into a substantial portion of the total distance. This indicated to the researchers of the early 1960's that a long step in balance with the other two phases was the key to producing outstanding performances. This emphasis on the step distance later evolved into what is now known as the philosophy of balanced phase distances.

The performances of Willie Banks, Mike Conley, and Al Joyner of the United States during the 1980's indicated to some researchers a trend, that by the mid 1990's the style pendulum will have swung back to a point where once again the step will be used only as a linking phase. In a study that compared the phase distances and phase ratios for the top four finishers in the 1985 TAC Championship Meet, Miller and Hay (1986) found with respect to Banks, Conley, and Joyner, "...as they increased their effective distances, all three subjects decreased the emphasis they placed on the step phase (p 278)." They concluded, "Although the small sample size in this study does not permit any conclusive statement to be made on the issue, the observed shifting of emphasis from the step phase to other phases suggests that in elite triple jumping, maximizing the length of the step phase may not be conducive to maximizing the overall distance (p 278)."

Perhaps what this shift in thinking really tells us is that — as we have already seen with the Japanese's Big Hop Style, Metcalfe's Big Jump Style, and Shcherbakov's Big Step Style - numerous possibilities may exist for elite performers.

The Balanced Style

As jumpers and coaches took triple jump technique from one extreme to the other, many of them began to suspect that it was not to their advantage to emphasize one phase over another. In spite of Mikio Oda's natural inclination toward the Big Hop Style, the 1928 Olympic champion began to suspect as early as 1924 that by overemphasizing the hop, he may be hurting his performance. Oda (1949) noted, in recalling the 1924 Olympic Games in Paris, that

> At the Olympics, Australia's Mr. Winter made a new world's record with a jump of 50 feet 11 and 1/4 inches. I still remember that he and Mr. Tuulos of Finland left a strong impression on me with their method of jumping. Their method was to make each jump with a strong takeoff to accentuate each jump (p 13).

He believed that by decreasing his hop distance from 21 feet to 20 feet and by increasing his step distance from 14 feet to 15 feet he could conserve enough momentum to produce a long jump-phase. "The objective is to extend the overall distance of the jump through speed, rather than by rhythm in the jump. To do this one must hop lower than formerly and, moreover, one must move his legs quicker (Oda, 1949, p 13)." Oda went on to win the 1928 Amsterdam Olympics, and later in 1931 established a new world record of 51'1 3/8" with phase ratios of 41% : 22% : 36% (Tan, 1959, p 22). However, assuming that Oda attempted to implement what he saw in Paris in 1924, it is questionable whether he ever learned to accentuate each phase as he had hoped to do.

Although as early as 1924 there were a number of elite jumpers who attempted to balance their phase ratios, it was not until 1950 that the *Balanced Style* became popular (see Figure 4). In 1950, Adhemar da Silva tied Tajima's world record with the greatest series of jumps up to that time. The following statistics illustrate the balance of his phase distances (Doherty, 1976).

	HOP	STEP	JUMP	TOTAL
1.	18'8 3/4"	14’5 1/4"	16’4 7/8"	49’6 7/8"
2.	17’10 5/8"	15’2 5/8"	18’7/8"	51’2 1/8"
3.	17’8 1/4"	15’3"	18’2 1/2"	51’1 3/4"
4.	18’2 1/2"	15’6 1/4"	18’6"	52’2 3/4"
5.	18’2 1/2"	15’8 5/8"	18’7 5/8"	52’6 3/4"foul
6.	18’1 3/8"	15’10 1/2"	18’6"	52’5 7/8"

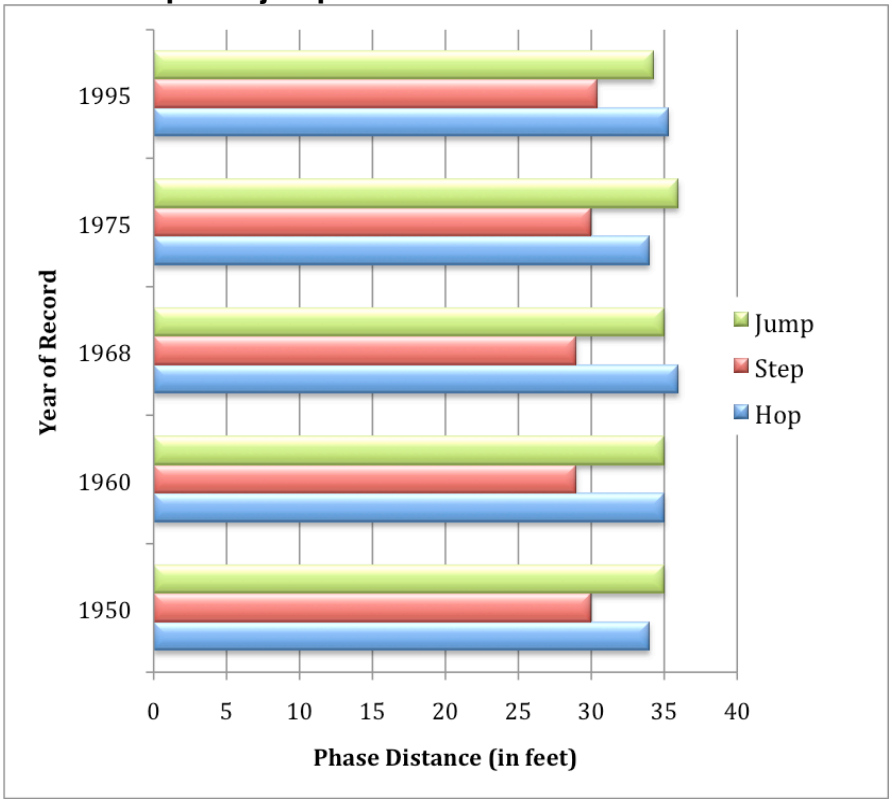
Doherty (1976), commented on the balance of da Silva's phases in the following way: "The relative lengths of the hop, the step, and the jump warrant careful study for they are very similar to those of modern jumping. On a percentage basis, the three phases of his final record comprised 34.5% : 30.1% : 35.4% of the total effort, a very well-balanced performance, even by modern standards (p 185)."

Josef Schmidt, the 1960 and 1964 Olympic champion, used this style predominantly. During the 1960's the Balanced Style evolved from more than just a style used by one or two successful jumpers. Largely due to Schmidt's success, it became a philosophy of triple jumping. Even though he emphasized the jump phase, his first two phases did not suffer. In one meet during the 1960 season, he hopped 19'8 1/4", stepped 16'5 1/4", and jumped 19'8 3/4", while establishing a world record of 55'10 1/4". His resulting percentage pattern was 35.2% : 29.4% : 35.4%. This performance not only reinforced the balance philosophy, but also alerted everyone concerned to the importance of maintaining momentum throughout the entire performance of the triple jump.

Tan (1970) also defined the Balanced Style in terms of how much emphasis is placed on the step phase, "...the only difference between the present and the past is that the present jumpers have reasonably long steps. In other words, the jumpers of today have balanced phases (p 205)." Dyson (1977) expressed the essence of the Balanced Style when he explained simply, "The basic principle in the triple-jump is that no one phase must be stressed to the detriment of the overall effort (p 168)."

Even though Viktor Saneyev was considered a Russian Style jumper (meaning that he relied heavily on the hop phase), judging by the phase apportionments of his 1968 world record (36% : 29% : 35%), he was also influenced by the balanced philosophy. In 1975, using the Balanced Style, Joao Carlos de Oliveira of Brazil used a percentage pattern of 34% : 30% : 36% in order to set a world record of 58'8". After considering these reported phase ratios as well as ratios reported in other studies, for this study I will define the Balanced Style as having phase ratios where the step is 29% or greater and the hop and jump have no more than a 2% differential.

Figure 4 -- The Balanced Style
Phase Ratios for Official World Records where the step is 29% or greater and the hop and jump have no more than a 2% differential



In their study of the 1987 World Championships, Susanka et al. (1987) analyzed the percentage patterns of the twelve finalists. They avoided confusing labels and simply described the patterns used. From their results, they classified the percentage patterns of the finalists into the following six groups.

1. 36.5% : 30.0% : 33.5% (Markov, Pastusinski)
2. 34.5% : 31.5% : 34.5% (Conley, Taiwo, Elliot)
3. 38.0% : 30.0% : 32.0% (Sakirkin, Hoffmann)
4. 35.5% : 32.0% : 32.5% (Kovalenko, Procenko)
5. 33.5% : 33.0% : 33.5% (Bouschen)
6. 36.0% : 29.0% : 35.0% (Badinelli, Slanar)

They concluded, "We believe that 18m (59') can be achieved by several variations of technique. The athletes who stand the best chance are those with percentage patterns of 36.0% : 30.5% : 33.5% (6.5m + 5.50m + 6.00m, i.e. Markov) and 34.5% : 31.0% : 34.5% (6.20 + 5.60 + 6.20 m, i.e. Conley)." It is interesting to note that the researchers' "optimal" percentage patterns are, essentially, what we have called the Russian Style and the Balanced Style respectively.

In 1995 Jonathan Edwards performed a Bob Beamon(est) feat by "skipping" over the 58'11 1/2" (17.97m) world record to set a new world record of 60' 0"(18.29m). However, earlier that season Edwards had jumped even further, 18.43m, but this world record could not be ratified because it was wind aided. For that wind aid mark, percentage patterns of 35.3% : 30.4% : 34.3% (6.50m + 5.60m + 6.33m) were recorded. These percentage patterns show that the Balance Style is indeed an excellent performance strategy.

SUMMARY AND CONCLUSION

It should be remembered that the first purpose of this study was to trace the evolution of triple jump technique focusing on the evolution of the phase ratios. The primary goal, then, was to record history. What this review of triple jump history shows is that, in this particular sport, *conserving horizontal momentum across all three phases has been **THE** unique challenge* to both the athlete and the coach in their effort to achieve maximum distance. Various strategies, involving the three phases, have been tried in order to conserve momentum.

As the record shows, once coaches and triple jumpers realized that the apportionment of the phase distances is a critical determinant to the jumper's performance, they began to search for the best of all possible apportionments. From lack of a more systematic method, they conducted their search by trial and error. As a result, jumpers have experimented with extremes in phase apportionment resulting in extremes in triple jump style. Experimentation has led jumpers to emphasize each phase individually as well as to emphasize various combinations of phases; and their search - as this study shows - has swung somewhat like a pendulum.

Nevertheless, some clear trends have emerged. The first noticeable trend in triple jump technique was to use the *Step as a Link*. This style of triple jump emphasized both the hop and jump phases, while using a short step phase to link the two.

This was followed by a trend, particularly among the Japanese, to stress the hop phase. The Japanese also used the step as a linking phase. However, their style was also characterized by an extremely long hop-phase, hence, the origin of the *Big Hop Style*.

After a brief dominance, the Big Hop Style was shortly superseded by a shift to the other extreme: emphasis upon the jump phase initiated by Metcalfe, who toppled the Japanese in world dominance. However, because of the absence of major competitions during World War II the full potential of the *Big Jump Style* was never fully developed. When competition resumed after the hiatus produced by the war, the trend moved quickly toward lengthening the step phase. This was part of the developing strategy to conserve momentum by attempting to balance the phase distances. In the 1950s and 1960s Brazilian jumper, Adhemar da Silva and Polish jumper, Josef Schmidt produced world records using a variation of the Big Jump Style. They executed long jump-phases while keeping their step length in relative balance. In honor of Josef Schmidt, this variation of the *Big Jump Style* has been given the title, *The Polish Style*.

Largely due to da Silva's and Schmidt's successes, the attempt by elite triple jumpers to balance the phases evolved from more than just a style it became a philosophy of triple jumping, now known as the *Balanced Style*. Now, in the early 21st century, Jonathon Edward's "Beamon(est)" world record as shown that the *Balanced Style* is indeed a viable style for achieving maximum distance.

This survey of triple jump history indicates that, numerous styles exist from which elite performers can choose in seeking the best or optimal apportionment of the phase distances. It now appears that after more than a century of trail and error, jumpers and their coaches are starting to hone in on the optimal phase apportionments. The case is still open, however, and I believe it will remain open for sometime, until a more systematic, methodical, and quantitative approach is used. This quantitative approach must involve experimental manipulation of the phase apportionments in order to collect data, which can then be fed into mathematical models of triple jump.

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