

TWIST DIRECTION



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Twisting and somersaulting make up the majority of flight skills in gymnastics. The gymnastics coach often faces the brunt of the problems related to twist direction due to poor initial learning and resulting bad habits. Gymnasts often learn rudimentary twisting, cartwheel, round off directions, and so forth long before they come to a serious coach. Moreover, given the typical backyard tumbling experiences of young gymnasts, a round off is often discovered from a very early age.

Recent discussions on the USA Gymnastics Web site, personal communication with coaches, and abundant unsupported claims led me to explore the issue of twist direction and how a coach might predict the optimum twist direction for a gymnast. In order to investigate the relative distributions of twist and turn directions, I began by observing twist and turn directions at the 1999 Classic Competition held in Rochester, NY. Following the observations, I sent a brief survey questionnaire to coaches for whom I had their email addresses. The observations were recorded by hand at the competition, while the surveys were returned by a number of coaches. In all, 244 athletes' information was provided. The observations at the Classic competition sometimes missed one or more categories of information simply because the gymnast did not perform that category of skills during her competitive routine. When data from a category are lacking, the results are listed in the following tables as "Missing."

The competitive levels surveyed are shown in Table 1. Table 1 shows that the majority of athletes were Level 10 and above (70.1%). The athlete's competitive levels are probably biased somewhat due to the observations being of elite athletes, and the email list coming largely from the U.S. Elite Coaches Association for Women's Gymnastics. However, since Level 10s and above are more likely to be performing a wider variety of twisting elements, it is probably fortuitous that the sample includes these athletes.

Table 1. Competitive Level

LEVEL	FREQUENCY	PERCENT
6.00	3	1.2
7.00	8	7.4
8.00	26	10.7
9.00	26	10.7
10.00	61	25.0

Nat Elite	36	14.8
Jr Internat	40	16.4
Sr Internat	34	13.9
Total	244	100.0

The descriptive information showing the number of responses for each variable from all the athletes regarding twist and turn direction is shown in Table 2. The variables are self-explanatory, with the exception of the "pirouette." A pirouette in this context refers to a forward or inward turn on one foot.

Table 2. Descriptive Statistics

VARIABLE	FREQUENCY	%	MISSING	%
Backward Twist	241	98.8	3	1.2
Forward Twist	180	73.8	64	26.2
Jump Turn	230	94.3	14	5.7
Pirouette	223	91.4	21	8.6
Round Off First Hand	244	100.0	0	0.0

Table 3 shows the number of responses for all athletes regarding forward and backward twist direction. Note that more athletes twist to the left in both forward and backward somersaults. However, the distributions of twist directions were not statistically different (Backward Twist $\chi^2(1) = .104$, $p = .747$; Forward Twist $\chi^2(1) = 2.222$, $p = .136$). The lack of statistical difference means that the distribution of twist directions in both forward and backward twisting is approximately equal between left and right.

Table 3. Twist Direction

DIRECTION	FREQUENCY	PERCENT
Backward Twist		
Left	123	50.4
Right	118	48.4
Total	241	98.8
Missing	3	1.2
Forward Twist		
Left	100	41.0
Right	80	32.8
Total	180	73.8
Missing	64	26.2

Table 4 shows the frequency of responses involved in jump turns and pirouettes. Note that the majority of athletes prefer left turns in a jump turn, while they prefer right turns when performing a pirouette. The "Both" category indicates that the gymnast performs these turns in either direction. The jump turn directions (excluding "Both") were not statistically

different $\chi^2 = 1.818$, $p = .178$). The pirouette directions (excluding "Both") were not statistically different $\chi^2 = 0.558$, $p = 0.455$).

Table 4. Turns

DIRECTION	FREQUENCY	PERCENT
Jump Turn		
Left	120	49.2
Right	100	41.0
Both	10	4.1
Total	230	94.3
Missing	14	5.7
Pirouette		
Left	103	42.2
Right	114	46.7
Both	6	2.5
Total	223	91.4
Missing	21	8.6

Round offs are among the first skills that a young gymnast learns, usually teaching herself through imitation. Round offs are usually developed from a cartwheel and are used for many other skills and drills. Because the gymnast must place one hand down before the other in a cartwheel and round off, the selection of the appropriate hand is an important consideration. Round offs are also somewhat enigmatic with regard to twist direction. Without going into detail, if the gymnast places her left hand down first-she is twisting to the right and vice-versa. Cartwheels and round offs are among the first opportunities for a young gymnast to perform turns while inverted. Table 5 shows the frequencies of which hand is placed first in a round off. Note that the majority of the athletes place their right hand down first. The choice of which hand to place first in the round off was also not statistically different ($\chi^2 = 2.770$, $p = 0.096$).

Table 5. Round Off

1ST HAND DOWN	FREQUENCY	Percent
Left	109	44.7
Right	135	55.3
Total	244	100.0

Table 6 shows the relative frequencies of directions based on the first hand placement in the round off. Clearly, the choice of forward and backward twist direction, once the round off direction is determined, shows significant trends as indicated by the statistically significant χ^2 values.

Note that the trends appear different depending on which hand is placed first in the round off. With regard to backward twisting, if the gymnast places her left hand down first, she will twist left approximately 80% of the time. However, if the gymnast places her right

hand down first, she will twist right only approximately 70% of the time. This difference is statistically significant indicating that the difference in twist choice based on round off direction is not likely to have occurred by chance (Cramer's $V = .523$, $p < .001$).

Table 6. Round Off As Predictor

VARIABLE	FREQ.	%	VARIABLE	FREQ.	%
Lt. Hand Down 1st			Rt. Hand Down 1st		
BACKWARD TWIST			BACKWARD TWIST		
Left	87	79.8	Left	36	26.7
Right	22	20.2	Right	96	71.1
Missing	0	0.0	Missing	3	2.2
Total	109	100.0	Total	132	97.8
$\chi^2 = 38.761$, $p < .001$			$\chi^2 = 27.273$, $p < .001$		
FORWARD TWIST			FORWARD TWIST		
Left	64	58.7	Left	36	26.7
Right	17	15.6	Right	63	46.7
Missing	28	25.7	Missing	36	26.7
Total	81	74.3	Total	99	73.3
$\chi^2 = 27.272$, $p < .001$			$\chi^2 = 7.364$, $p = .007$		
JUMP TURN			JUMP TURN		
Left	80	73.4	Left	40	29.6
Right	20	18.3	Right	80	59.3
Both	3	2.8	Both	7	5.2
Missing	6	2.9	Missing	8	5.9
Total	103	94.5	Total	127	94.1
$\chi^2 = 95.32$, $p < .001$			$\chi^2 = 63.134$, $p < .001$		
PIROUETTE			PIROUETTE		
Left	89	81.7	Left	14	10.4
Right	9	8.3	Right	105	77.8
Both	4	3.7	Both	2	1.5
Missing	7	6.4	Missing	14	10.4
Total	109	100.0	Total	121	89.6
$\chi^2 = 133.824$, $p < .001$			$\chi^2 = 157.306$, $p < .001$		

Although this small effort at deciphering twisting direction will probably not eliminate controversies among coaches, it is clear that trends on twist direction are evident. The magnitude of these trends indicates that although evident, these trends are not applicable to all gymnasts. Moreover, the fact that much of the data used for this study was obtained during a competition including some of our nation's best female gymnasts, it is clear that a variety of twist direction approaches may be incorporated even among the best gymnasts. The information included here may help coaches make initial decisions with regard to twist and turn direction based on preferences. One study was found in the literature that

investigated the relationship between preferred twist direction and hand and eye dominance (Brown, *et al.* 1983).

This study surveyed 171 gymnasts ($n = 51$) and non-athletes ($n = 115$). No significant correlations were found between twist direction and hand or eye dominance. As the gymnast progresses, it may be wise to experiment with both directions of turn and twist to ensure that the gymnast has adequate opportunity to demonstrate a preference. Short of this, it appears that the majority of gymnasts who do a round off with a particular first-hand will twist in the same direction as that hand. However, the relationship is not strong enough to allow rule-like assessment and the direction of the round off interacts with the backward twist direction.

References

Brown, J.; Tolsma, B.; Kamen, G. (1983): Relationships between hand and eye dominance and direction of experienced gymnasts and non-athletes. *Perc. Mot. Skills* 57, 470.