Lane Bias at the 2016 Olympic Swimming Competition

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Introduction

We were first drawn to the potential for a lane bias in swimming by persistent rumors coming from athletes and coaches of a water current in the competition pool during 2013 FINA World Swimming Championship. When we analyzed performance data from the competition, we found strong evidence in support of these rumors. The 50-meter splits from the distance freestyle events were consistently slower when swimmers were swimming towards the finishing end as compared to away from it on one side of the pool (lanes 1-4), and the opposite was true on the other side of the pool (lanes 5-8): swimmers were faster when swimming towards the finishing end than away from it. Based upon our observations from the distance freestyle events and supposing a current caused them, we reasoned the effect would be most evident in the 50-meter events where athletes only complete one length of the pool. We hypothesized that swimmers in lanes 1-4 would be at a disadvantage in the 50-meter events whereas the swimmers in lanes 5-8 would be at an advantage. And that is exactly what we found! (See Cornett, Brammer, & Stager, 2015 for more on this analysis; full reference information is below.)

Although the data from our first study are convincing, many in the swimming world were skeptical of our results. It was common for individuals to acknowledge that a problem existed at the 2013 World Championships, but to also insist that it was an isolated occurrence. And so we asked ourselves that very question: Was the 2013 World Championship competition unique or is there evidence of similar lane biases at other elite-level swim competitions? In an effort to answer this question, we analyzed performance data from an additional 16 national- and international-level competitions. **Our findings provided strong evidence that the 2013 World Championship was not unique. Similar biases were evident at other elite-level competitions.** (See Brammer, Cornett, & Stager, 2016 for more on this analysis; full reference information is below.)

Our goal all along has been to bring about awareness of lanes biases in swimming in the hope that the problem would be addressed and then eliminated. There is evidence that factions within the swimming community are aware of the problem. Personal communications with U.S. national swim coaches indicate that lanes biases and water currents were discussed at the 2016 Olympic swimming competition. However, while high-ranking members of the swimming world seem to be taking note, our data suggest that the problem persists. Our analysis of the performance data from the 2016 Olympics suggest that performances were once again affected by the lane to which swimmers were assigned.

2016 Olympic Analysis

Distance Freestyle Events

We started our analysis of the 2016 Olympic swimming competition by analyzing the 50-meter split times from the distance freestyle events (800-meter Freestyle for women and 1500-meter freestyle for men). We calculated the mean difference between the odd 50-meter splits (swimming away from the finishing end) and the even 50-meter splits (swimming towards the finishing end) for each swimmer. The results are shown in Figure 1. A negative value indicates that the swimmer was slower swimming towards the finishing end than away from it whereas a positive value means that the swimmer was faster swimming towards the finishing end than away from it. So Figure 1 shows that the swimmers on one side of the pool (lanes 1-4) tended to be **slower** when swimming towards the finishing end as compared to swimming away from it, and the swimmers on the opposite side of the pool (lanes 5-8) tended to be **faster** when swimming towards the finishing end as

compared to swimming away from it. And importantly, the effect seems to be the strongest in the outermost lanes. This is an unexpected result as it is typical for swimmers to repeat laps with very little variance. It is critical to note that our analysis of the distance freestyle events was focused on 50-meter splits, not actual race outcomes.

Whether or not race outcomes were influenced is a more difficult question to address. Our logic is that if race outcomes were affected, it will be most evident in the 50-meter events. In all events other than the 50-meter events, the athletes complete an even number of lengths of the pool. As a result, any advantage a swimmer gets when swimming in one direction is partially offset by a disadvantage when swimming in the opposite direction. The 50-meter events, though, are only a single length of the pool, so any advantage or disadvantage would not be simply offset on subsequent lengths.

50-meter Freestyle Events

The next step is analytically a bit more complicated. We started our analysis of the men's and women's 50-meter freestyle by calculating the change in performance from the preliminary round to the semifinals for all swimmers that qualified for the semifinals. And similarly, we calculated the change in performance from the semifinals to the finals for all swimmer that qualified for the finals. We then formed groups based on swimmers' lane assignments for the preliminary and semifinal swims or for the semifinals and finals swims. If a swimmer competed in lanes 1-4 for both the preliminaries and semifinals or for both the semifinals and finals, then the performances were assigned to the LL (or low-low) lane group. Similarly, if both swims took place in lanes 5-8, then the performances were assigned to the HH (or high-high) lane group. We were most interested in the performances where the swimmer moved from one side of the pool to the other side of the pool. If the swimmer was in lanes 1-4 for the first swim and lanes 5-8 for the second swim, the performances were assigned to the LH (or low-high) lane group. Conversely, if the swimmer was in lanes 5-8 for the first swim and lanes 1-4 for the second swim, the performances were assigned to the HL (or high-low) lane group.

The percent change in performance from one round to the next for each lane group is displayed in Figure 2. We can make a few important observations from this figure. First, the LL and HH lane groups got faster with advancing round. This was not a surprise. We have analyzed performance data from many elite-level swim competitions, and we have consistently found that swimmers in the 50-meter events tend to get faster with advancing round. **What is very uncommon is to find a group that performs worse in the 50-meter events when advancing from the prelims to the semifinals or from the semifinal to the finals. And that is exactly what happened with the HL group at the 2016 Olympics!** Of the 16 athletes that were in HL group, 14 got slower. The LH group, on the other hand, clearly got faster with advancing round. Of the 10 athletes that were in the LH group, 7 got faster.

Whether or not swimmers in the LH group improved more with advancing round than the LL and HH groups is difficult to say, but looking at the individual data from the 50-meter freestyle events can help us to understand the overlap in these groups (See Figures 3 and 4 below). First, recall from Figure 1 that the lane bias seemed to be strongest in the outer lanes (1-3 and 6-8) and minimal in the middle lanes (4-5), if it existed at all. With this in mind, we can re-form our LH and HL groups by excluding lanes 4 and 5. There were four cases in which a swimmer competed in the prelims or semifinals in lanes 1-3 and then competed in one of lanes 6-8 for semifinals or finals. These four swimmers were 0.94% **faster** from the first swim to the second. Similarly, there were eight cases in which a swimmer competed in the prelims or semifinals in lanes 6-8 and then competed in one of lanes 1-3 for the semifinals or finals. These eight swimmers were 0.94% **slower** from the first swim to the second. Finally, there were 11 instances in which swimmers competed in one of lanes 1-3 or lanes 6-8 for both their first swim and second swim. As a group, these swimmers improved their performance by an average of 0.5%, which coincided with what was expected by 50-meter swimmers at elite-level competitions.

Conclusion

Taken together, this report on the 2016 Olympic swimming competition and our previous analyses (Cornett, Brammer, & Stager, 2015; Brammer, Cornett, & Stager, 2016) provide compelling evidence that **lane biases can and do occur in elite-level swim competitions.** Since we did not measure the physical properties of the swimming pools in any of these cases, we cannot say for sure if the lane biases were caused by water currents or other factors. What we can say, however, is that **our results have been consistent with water currents in the competition pools.** There is no other plausible explanation. While there isn't much that can be done about past competitions, there certainly is much that can be done for future ones. We hope that FINA, the entity responsible for ensuring fairness and equal opportunity for success, will carefully consider this evidence and move towards rules and regulations that might keep similar lane biases from occurring at future competitions. Most importantly, some procedure is needed to confirm that all sanctioned meets are free from external influences that unfairly hinder or assist race outcomes.

References

Brammer, C. L., Cornett, A. C. & Stager, J. M. (2016). Lane bias in elite-level swim competitions. ***Journal of Sport Science***, in press.

Cornett, A. C., Brammer, C., L., & Stager, J. M. (2015). Current controversy: Analysis of the 2013 FINA World Swimming Championships. ***Medicine and Science in Sports and Exercise***, 47(3), 649-654.

Figures

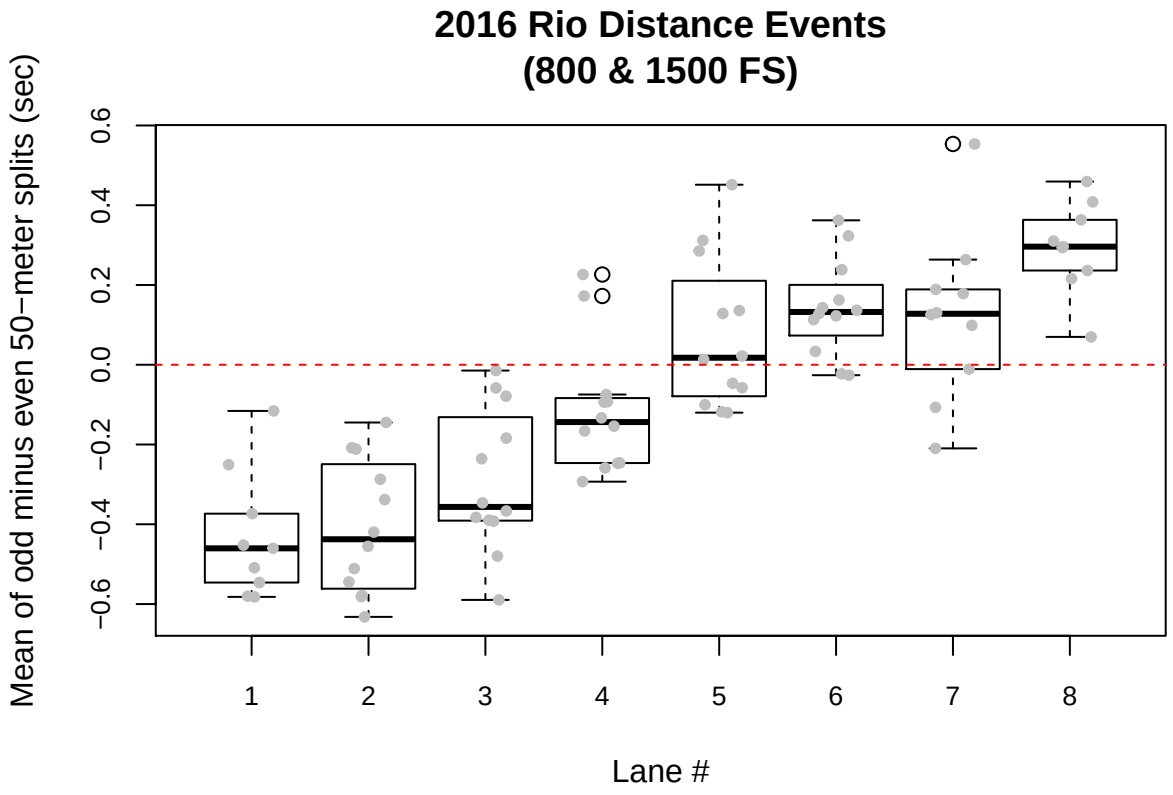

Figure 1: The mean difference between the odd 50-meter splits and the even 50-meter splits from the distance freestyle events at the 2016 Rio Olympic Games. Each data point represents the mean difference for a given swimmer. Negative values mean the swimmer was consistently slower when swimming toward the finish end of the pool (even lengths).

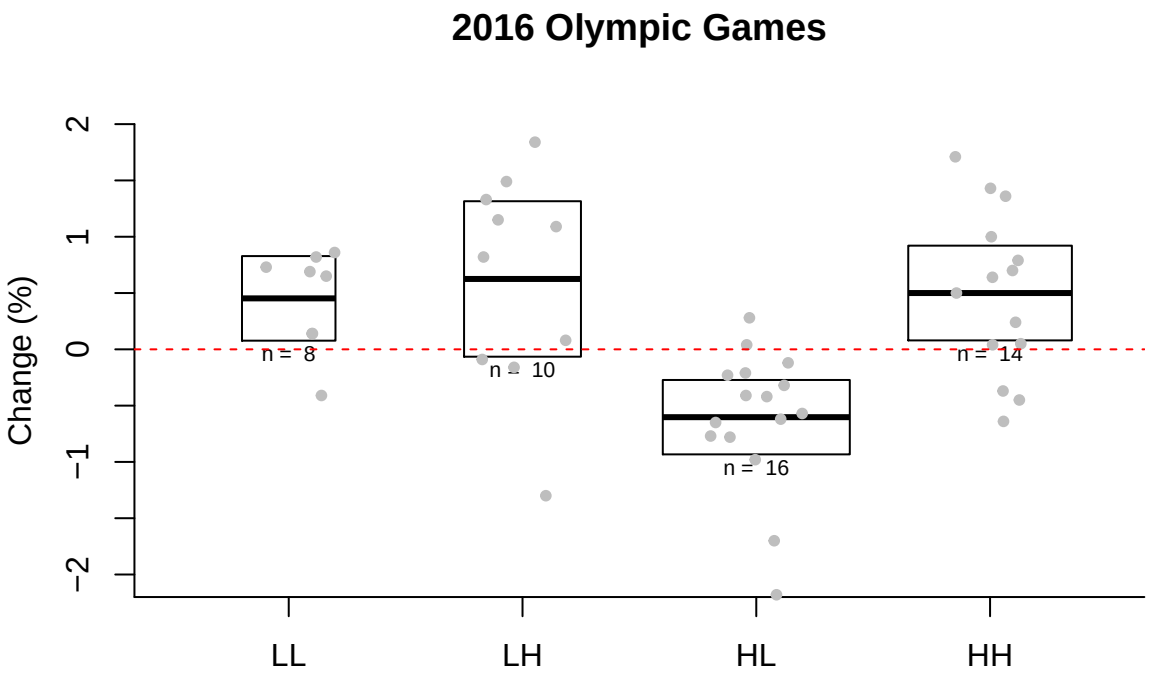

Figure 2: The percent change in 50-meter performance from preliminaries to semifinals or from semifinals to finals for four lane change scenarios, which represent the lane assignments for the pair of swims, at the 2016 Rio Olympic Games. Swimmers that competed in lanes 1-4 or 5-8 for both swims were assigned to LL (n=8) and HH (n=14), respectively; swimmers that competed in lanes 1-4 for their first swim and lanes 5-8 for their second swim were assigned to LH (n=10); and swimmers that competed in lanes 5-8 for their first swim and lanes 1-4 for their second swim were assigned to HL (n=16). Positive values mean that the swimmers got faster from prelims to semifinals or from semifinals to finals. Negative values mean that the swimmers got slower. Swimmers grouped in the HL scenario got slower as they progressed through the stages of the competition by about 0.5%, which was a significantly worse result than the other groups. The only other occasion where a scenario showed a significant decline in performance occurred at the 2013 World Championships.

Swimmer_ID	prelim	semi	final	lanep	lanesf	lanef	deltsf	deltf	catsf	catf
ERVINAnth	21.63	21.46	21.4	5	5	3	0.79	0.28	HH	HL
MANAUDOUFlor	21.72	21.32	21.41	4	5	4	1.84	-0.42	LH	HL
ADRIANNath	21.61	21.47	21.49	4	4	6	0.65	-0.09	LL	LH
PROUDBen	21.83	21.54	21.68	3	6	2	1.33	-0.65	LH	HL
GOVOROVAndr	21.49	21.46	21.74	3	4	5	0.14	-1.3	LL	LH
FRATUSBrun	21.93	21.71	21.79	5	7	7	1	-0.37	HH	HH
TANDYBrad	21.94	21.8	21.79	6	7	8	0.64	0.05	HH	HH
BILISSimo	22.01	21.71	22.08	8	8	1	1.36	-1.7	HH	HL
DOTTOLuca	21.87	21.84		2	2		0.14		LL	
MOROZOVVlad	21.81	21.88		5	3		-0.32		HL	
McEVOYCame	21.8	21.89		4	3		-0.41		LL	
CONDORELLISant	21.83	21.97		7	6		-0.64		HH	
GKOLOMEEVKris	21.93	21.98		6	2		-0.23		HL	
TRANDAFIRNorb	22.1	21.99		8	8		0.5		HH	
DUATRTEItal	21.96	22.05		6	1		-0.41		HL	
SHIOURAShin	22.01	22.18		7	1		-0.77		HL	

Figure 3: 2016 Rio Olympic men's 50-meter performance times, lane assignments, performance change (%), and lane-change scenarios. The variables **lanep**, **lanesf**, and **lanef** refer to the swimmer's lane assignment for the preliminary, semifinal, and final heats, respectively. **deltsf** and **deltf** refer to the swimmer's % change in performance time from prelim to semifinal and semifinal to final, respectively. Finally, **catsf** and **catf** refer to the lane change scenario for prelim to semifinal lane assignments and semifinal to final lane assignment, respectively.

Swimmer_ID	prelim	semi	fil	lanep	lanesf	lanef	deltsf	deltf	catsf	catf
BLUMEPern	24.23	24.28	24.07	6	4	4	-0.21	0.86	HL	LL
MANUELSimo	24.71	24.44	24.09	3	7	7	1.09	1.43	LH	HH
HERASIMENIAAlia	24.42	24.53	24.11	6	5	8	-0.45	1.71	HH	HH
HALSALLFran	24.26	24.41	24.13	5	4	6	-0.62	1.15	HL	LH
CAMPBELLCate	24.52	24.32	24.15	4	6	5	0.82	0.7	LH	HH
KROMOWIDJOJORano	24.57	24.39	24.19	4	2	3	0.73	0.82	LL	LL
CAMPBELLBron	24.45	24.43	24.42	4	5	2	0.08	0.04	LH	HL
MEDEIROSEtie	24.82	24.45	24.69	2	8	1	1.49	-0.98	LH	HL
VANDERPOOL-WALLACE	24.77	24.6		3	1		0.69		LL	
Van LANDEGHEMChan	24.57	24.61		3	6		-0.16		LH	
OTTESENJean	24.48	24.62		6	3		-0.57		HL	
WEITZEILAbbe	24.48	24.67		5	3		-0.78		HL	
SJOSTROMSara	24.66	24.69		5	2		-0.12		HL	
BRANDTDoro	24.77	24.71		7	8		0.24		HH	
ALSHAMMARTher	24.73	24.72		7	7		0.04		HH	
DEKKERInge	24.77	25.31		7	1		-2.18		HL	

Figure 4: 2016 Rio Olympic men's 50-meter performance times, lane assignments, performance change (%), and lane-change scenarios. The variables **lanep**, **lanesf**, and **lanef** refer to the swimmer's lane assignment for the preliminary, semifinal, and final heats, respectively. **deltsf** and **deltf** refer to the swimmer's % change in performance time from prelim to semifinal and semifinal to final, respectively. Finally, **catsf** and **catf** refer to the lane change scenario for prelim to semifinal lane assignments and semifinal to final lane assignment, respectively.