# Sprint performance and propulsion asymmetries on an ergometer in trained high- and low-point wheelchair rugby players

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Running Head: Asymmetries in wheelchair sprinting

## Abstract

The purpose of this study was to examine the propulsion asymmetries of wheelchair athletes whilst sprinting on an instrumented, dual-roller ergometer system. Eighteen experienced wheelchair rugby players (8 low-point (LP) (class ≤1.5) and 10 high-point (HP) (class ≥2.0)) performed a 15s sprint in their sports wheelchair on the instrumented ergometer. Asymmetry was defined as the difference in distance and power output (PO) between left and right sides when the best side reached 28m. Propulsion techniques were quantified based on torque and velocity data. HP players covered an average 3m further than the LP players ($P$=0.002) and achieved faster sprint times than LP players (6.95 ± 0.89 vs. 8.03 ± 0.68 s, $P$=0.005) and at the time the best player finished (5.96 s). Higher peak PO's (667 ± 108 vs. 357 ± 78 W, $P$=0.0001) and greater peak speeds were also evident were for HP players (4.80 ± 0.71 vs. 4.09 ± 0.45 $m \cdot s^{-1}$, $P$=0.011). Greater asymmetries were found in HP players for distance (1.86 ± 1.43 vs. 0.70 ± 0.65 m, $P$=0.016), absolute peak PO ($P$=0.049) and speed (0.35 ± 0.25 vs. 0.11 ± 0.10 $m \cdot s^{-1}$, $P$=0.009). Although HP players had faster sprint times over 28m (achieved by a higher PO), high standard deviations show the heterogeneity within the two groups (e.g. some LP players were better than HP players). Quantification of asymmetries is not only important for classifiers but also for sports practitioners wishing to improve performance as they could be addressed through training and/or wheelchair configuration.

**Keywords**: Tetraplegic; wheelchair propulsion; dual-roller system; Paralympic sport; asymmetry

## Introduction

Wheelchair rugby (WCR) is designed for individuals with both lower and upper limb impairments which includes players with a spinal cord injury (SCI) at the cervical region of the spinal cord (known as tetraplegia), cerebral palsy (CP), multiple amputations and neuromuscular disease (IWRF, 2016). Based on physical impairment, WCR players are classified into one of seven classification groups from 0.5 (most impaired) to 3.5 (least impaired) (IWRF, 2016) to minimise the impact of impairment on the outcomes of competition (Tweedy & Vanlandewijck, 2011). Our understanding of the sport to date is that high-point (class 2.0-3.5; HP) players are able to execute greater peak speeds compared to low-point (0.5-1.5; LP) players (Rhodes et al., 2105a; Rhodes et al., 2015b). Moreover, time spent performing high-speed activities have been noted to be greater in HP compared to LP players (Rhodes et al., 2015a). Consequently, sprint performance is a key aspect of WCR, since accelerating faster than your opponent is essential to be free to catch the ball; preferably in the end zone (Malone & Orr, 2010; van der Slikke et al., 2016).

Yet in-depth biomechanical analyses of sprint performances on court are difficult because instrumentation of the individually optimized wheelchair-user configuration requires high-end sensitive measurement techniques that might also alter an athlete’s performance (Vanlandewijck et al. 2001; Mason et al. 2013). Therefore, instrumented dual-roller ergometers have been developed that allow measurement of power output (PO) in combination with acceleration, while importantly keeping the wheelchair-user combination unaltered (Devillard et al. 2001; Faupin et al., 2004). One clear difference with propelling on court however is the removal of a steering component while propelling on such a stationary device, allowing for differences in left-right performance without a consequent change in direction over ground.

Interestingly, the assumption of whether wheelchair propulsion is considered a symmetric bimanual task has recently resurfaced during conditions of daily manual wheelchair propulsion while propelling at a low-intensity steady-state velocity (Vegter et al. 2013; Vegter et al. 2014; Soltau et al., 2015; Chénier et al. 2017). Although for a balanced wheelchair user combination the PO on average must be the same on both sides (i.e. symmetric) to propel in a straight line, how this power production comes about can differ between the left and right side and is almost never the same when comparing the left and right push cycle directly to each other (i.e. asymmetric).

Inherent to some of the WCR players' health conditions, differences in strength and coordination between the left and right side are expected (Soltau et al., 2015). Especially during a sprint at maximal intensity in which case one approaches the biophysical limits of performance including the bimanual motor control of this task. However, on court given the constraints of straight-line propulsion these differences cannot be well assessed since the most impaired arm inhibits the less impaired one to perform more power, which would result in a turn. There has been a reinstated interest in the measurement of short-term power during wheelchair propulsion with respect to resistive load (Hintzy et al., 2003), rear-wheel camber (Faupin et al., 2004) and propulsion modality (Faupin et al., 2013) using instrumented dual-roller wheelchair ergometers (Devillard et al., 2001). However, these aforementioned studies have been limited to able-bodied female participants or wheelchair basketball players and have not necessarily examined asymmetries in bimanual PO, or the different wheelchair user interface of specialized sport chairs.

Despite the array of health conditions now eligible to play WCR only a few studies have examined the dynamic responses of WCR propulsion with respect to the HP and LP categories. For instance, some WCR players present an increased muscle tone or spasticity and impaired co-ordination leading to muscle imbalance and reduced muscle power (Paulson & Goosey-Tolfrey, 2017). As far as push symmetry is concerned, symmetrical and synchronous pushing modes are associated with greater wheelchair velocity and PO, and a close relationship has been shown to exist between upper arm coordination and technical efficiency (Faupin et al., 2013; Qi et al., 2013). These aforementioned studies, confirm the importance of push symmetry as a valuable performance indicator that has not been examined within the sport of WCR. Moreover, it is unknown as to whether asymmetries are more prevalent in HP players where there is potential for greater variation between arm scores than at the lower end of the classification system. Subsequently, the motor-coordination and PO of the left and right arms could be measured using the dual-roller wheelchair system. Therefore, the purpose of this study was to examine the sprint performance of experienced WCR players and to determine whether differences in asymmetries existed between HP or LP players.

## Materials and Methods

### Participants

Eighteen experienced WCR players (age 31 ± 6 yrs; body mass of 65.9 ± 14.0 kg) participated in this study. Diagnoses of physical disabilities met the eligibility criteria to participate in WCR: SCI of the cervical region (n=12), cerebral palsy (CP; n=2), amputation (AMP; n=1) and les autres (LA; n=3). In line with current WCR literature (Altmann, 2017; Rhodes et al. 2015a, 2015b) subgroups comprising of athletes classed according to the IWRF (IWRF, 2016) classifications as ≤1.5 (n=8) Low Point (LP) [6 SCI and 2 LA] and ≥2.0 (n=10) Mid-to-High Point (HP) [6 SCI, 2 CP, 1 AMP and 1 LA; consisting of 8 Mid and 2 High Point players] were formed.

Prerequisite for participation was prior experience in wheelchair sports and/or training at a national sporting level for >10 hours per week in WCR for a minimum of 4 years. For this reason, athletes had been advised on the optimisation of their WCR games chair (wheelchair-user interface; including whether wheelchair straps and/or an abdominal binder was used) and so had a reproducible acquired preference of arm movement frequency/ strategy for wheelchair propulsion. Body mass was recorded to the nearest 0.1 kg using a seated balance scale (Seca 710, Hamburg, Germany). The study was approved by the University Research Ethics Committee and all participants volunteered and provided written informed consent prior to participation.

### Wheelchair ergometer

All participants were tested in their own individualised WCR sports chair using a friction braked instrumented wheelchair ergometer (VP100H TE, HEF Tecmachine®, Andrezieux-Boutheon, France) which has been extensively detailed by Devillard et al. (2001) (Fig. 1). All players wore their usual gloves (with adhesive), strapping and some an abdominal binder as they would have when partaking in a competitive WCR game. Rear wheel tyre pressure was standardised to player's self-selected pressure, rear-wheel camber ranged from 16-20° and wheel size from 24-25 inches. Since testing involved players individually optimized wheelchair-user combination, no individual adjustments relative to anthropometric measures of the participants were made. The wheelchair ergometer system comprised of two pairs of independent rollers and was equipped with two electromagnetic brakes (Type ZX, Friedrichshafen, Germany), which has the capabilities to produce a braking torque of 0 Nm to 4 Nm, on both the left and right sides of the roller system. The roller system was calibrated prior to testing as described by Faupin et al. (2013) and prior to testing each participant performed a deceleration test to ensure equal resistance on each side of the rollers. The left and right rollers were independently capable of real time measuring velocity, torque and the angle of rotation at 100 Hz.

### Testing protocol

After a familiarisation period of 5 min self-paced propulsion, determination of individual residual torque (Tr)) were completed during five short practice coast-down sprints. For this, players completed four-five maximal pushes then leaned forward with their hands on their knees until the wheels came to a complete stop. Full details of this procedure have been described elsewhere (Faupin et al., 2013). In brief calculations of the individual Tr for both the left and right rollers allowed adjustments to be made to ensure equal resistance were applied on both sides. In line with current physiological assessments in our laboratory and Hutlzer et al. (1998), we kept the braking load to a Tr that was sport-specific and realistic to the wheelchair-user interface of WCR (proportional to the mass of the participant and chair combined which ranged 0.5-1.12 Nm). This was achieved by placing the rear wheels on the centre of the rolling element of each roller and strapping the front castor wheels down securely. Following a rest period of 3 min and some stretches, participants performed a 15s sprint from a stationary start on the wheelchair ergometer. A 15s sprint was chosen to ensure that at least 28m which represents the playing court distance was covered by all participants. Verbal encouragement was provided throughout the trial and pacing was not encouraged. Participants did not receive any feedback about their propulsion technique and their trunk movements were not restricted.

Custom written Matlab algorithms were used to analyse relevant biomechanical parameters and all values were recorded separately for the two wheels (de Groot et al., 2017; Vegter et al., 2013b). Torque and velocity data were low-pass filtered with a recursive second-order Butterworth filter (cut-off frequency 10 Hz). The PO at each side was calculated from the measured torque (M), wheel velocity ($v_w$) and wheel radius ($r_w$, 0.31 m):

$$\text{Power output} = M \cdot v_w \cdot r_w^{-1}$$

Timing parameters of the propulsion technique were determined from the torque signal. Push time was defined as the time that the hand exerted a positive torque on the hand rim. Push time and recovery time together represent the cycle time. The push time was also expressed as a percentage of the cycle time. Frequency was defined as the number of complete pushes over 28m of the sprint divided by the time it took to reach 28m. The work per push cycle was calculated as the power integrated over the wheel rotation angle. The contact angle was calculated from the angular velocity and defined as the angle at the end of a push minus the angle at the start. Furthermore, peak values of velocity ($m\cdot s^{-1}$) and PO (W) were calculated, both over the entire sprint and over the first three cycles only. The acceleration was calculated by taking the derivative of velocity, while the velocity signal was integrated for calculating the distance. Asymmetry (m) was defined as the absolute difference between the distances (m) covered left and right when the best side reached 28m (see Fig. 2 for an illustration and parameters calculated). E.g. in addition, the absolute differences in peak PO (W) and peak speed (m/s) between sides and their relative difference (% of the peak on the fastest side) were used to further quantify the differences between sides.

## Statistical analyses

The Statistical package for Social Sciences (SPSS, version 22; Chicago, IL, USA) was used for all statistical analyses. Means and standard deviations were computed for all variables and the average of the left and right side were used to compare between HP and LP players. The Shapiro-Wilk test showed that all outcomes were normally distributed. T-tests (unpaired) were used to compare the classification groups on relevant parameters. Statistical significance was set at $P < 0.05$. Effect sizes were calculated according to the mean differences between groups (LP and HP) and the pooled standard deviations of these differences, adjusted for unequal groups. The magnitude of the effects were defined as trivial (<0.2), small (0.2-0.6), moderate (0.6-1.2), large (1.2-2.0) and very large (>2.0) based on previous guidelines (Batterham & Hopkins, 2006). 90% confidence intervals (90% CI) were also calculated to determine the range within which the true effect sizes existed.

## Results

Age and body mass distribution were similar in both groups (31 ± 6 vs. 31 ± 6 yrs; 67.0 ± 13.4 vs. 64.6 ± 15 kg for HP and LP respectively), also there was no significant difference in rolling resistance between groups (0.93 ± 0.13 vs. 0.83 ± 0.28 Nm, *P*=0.22 for HP and LP respectively). On average HP players were quicker over 28m (*P*=0.005) and reached higher peak speeds PO's over the whole sprint and after the first 3 pushes ($P \leq 0.011$) than LP players (Table 1). At the time the quickest player finished, HP players had covered a greater distance (22.9 ± 3.2 vs. 18.9 ± 1.8 m, *P*=0.002) (Fig. 3a) than LP players. Differences were noted between the two groups in propulsion technique when an all-out effort 15s sprint was performed. During these sprints, it was shown that there was a significantly higher push frequency (*P*=0.014) and work/push (*P*=0.038) and a lower percentage push time (*P*=0.009) for the HP players. In contrast, no differences in contact angle were found between groups (Table 1). The differences in propulsion technique when sprinting between the two players (HP and LP) are clearly shown in Fig. 4.

High-point players also demonstrated greater asymmetries (distances travelled (m) between the left and right sides (*P*=0.016); see Fig. 3b), with a better symmetry evident for LP players. High-point players also demonstrated greater asymmetries in absolute peak PO (*P* = 0.049), peak speed (*P* = 0.009) and peak speed after 3 cycles (P = 0.046). Although in relative terms (% of peak) these were only greater for peak speed (*P* = 0.009). High-point players registered faster sprint times over 28m (achieved as noted earlier by a higher PO leading to higher acceleration and consequently higher top speeds). Yet, high standard deviations show the heterogeneity within the two groups (e.g., some LP players were faster than HP players) (Fig. 3a).

## Discussion

The aim of this research was to utilise a dual-roller ergometer system to assess the sprint performance and propulsion asymmetries of WCR players in their individually optimized sports wheelchair set-up. Given that acceleration of the wheelchair is considered to be one of the most important aspects of WCR game play (Malone & Orr, 2010), then it is important to determine sprint performance differences between players. The peak speeds achieved after 3 pushes (3.76 ± 0.47 and 3.20 ± 0.30 $m \cdot s^{-1}$; HP and LP respectively) were similar to those values reported during International wheelchair game play of similar IWRF classes (Rhodes et al., 2015a; Rhodes et al., 2015b), demonstrating the trained status and experience of the present sample. As expected, HP players achieved ~15% faster sprint times over 28 m than LP players (4.80 ±0.71 and 4.09 ±0.45 $m \cdot s^{-1}$), which were achieved by a higher peak PO (667 ±108 vs. 357 ±78 W), leading to higher acceleration and consequently higher top speeds. Yet, high standard deviations demonstrate the heterogeneity within the two groups and some LP players were faster than HP players. Training status and technical experience (Rhodes et al., 2015a), wheelchair configuration (e.g., wheel size, and/or camber) (Mason et al., 2013) to the functional abilities of the WCR player and total mass of the wheelchair-user combination (e.g., differences in rolling resistance and internal friction) were likely to have contributed to these differences in sprint performance. It is difficult to compare these values to other studies due to limited data on WCR players and also the fact that other wheelchair ergometer studies have restricted the maximal velocity to $\leq 3$ $m \cdot s^{-1}$. That said, to the authors' knowledge this is the only study that has examined the sprint performance on a dual-roller ergometer of highly trained athletes who are eligible to compete in WCR.

As described earlier, competitive WCR game play allows players with tetraplegia, CP, multiple amputations and neuromuscular disease to compete together (IWRF, 2016). Previous work has shown asymmetries in the daily propulsion patterns of individuals with tetraplegia (Stephens & Engsberg, 2010). The current study involved dynamic bouts of exercise (~10 s) under conditions very different to those found during daily wheelchair ambulation. Not only do the wheelchair configurations of a sports vs. daily wheelchair differ (e.g., increased camber and wheel size), but during WCR sports propulsion the site of force transfer can occur at the wheel (e.g. tire) as opposed the hand-rim (Mason et al., 2009). To compensate for lack of hand function/grip, WCR players wear gloves and apply an adhesive to assist with this coupling and decoupling of the hand to the tire when applying forces on the wheels (Mason et al., 2009). All players in this study wore bespoke individualised gloves. As we investigated two distinct groupings of IWRF classifications, it is important to note that previous research has suggested that HP players tend to push the wheelchair with the palmar side of their hand, whereas LP players frequently switched to a backhanded technique and contact the hand-rims with the dorsal side of their hand (Mason et al., 2009). Asymmetries in propulsion parameters were observed and were exacerbated in HP players, possibly due to the greater upper extremity demands clearly evident by higher PO's in this group. Because WCR performance is related to both trunk and arm impairment (Altmann et al., 2017), further work is warranted to examine these asymmetries at an individual level using more detailed classification scores which are attainable via the classification process.

Quantification of these asymmetries is important, since addressing them through physical training, pre-habilitation exercises and/or wheelchair configuration could lead to better performance (Roeleveld et al., 1994; Requejo et al., 2008). Wheelchair fitting and configuration can have a significant effect on the mobility performance of wheelchair games players (Mason et al., 2013) and typically LP players who have reduced trunk function prefer a more posterior seat position (Haydon et al., 2016) to try to maximise their capabilities for greater acceleration. Whilst it was beyond the scope of this study to consider the individual's anthropometrics and wheelchair configurations, it was of interest to note that higher velocity combinations (i.e., shorter push and cycle times) were evident in the HP group. Moreover, after the first 3 pushes asymmetries were greater in HP in peak speed and even when these asymmetries were relative based on peak speed, they were still significantly greater in HP. That said,  the side-to-side differences in PO warrants future study with respect to whether this occurred at the start of the sprint (e.g., problems with hand-to-tire coupling) or towards the end of the sprint (e.g., fatigue effects); whether the symmetry noted was due to the type of health condition (e.g., SCI vs. non-SCI) and/or whether there was asymmetric dynamic loading of the rollers. Nevertheless, the results of this study highlight the need to gather information on bilateral symmetry particularly if there are issues with secondary injury or pain (Stephens & Engsberg, 2010; Soltau et al., 2015). It is also unknown at present whether WCR players would be at a higher risk of shoulder pain from these side-to-side asymmetries on the court or even whether these asymmetries exist during daily ambulation in day-chair wheelchair-user combinations. Consequently, these results are of interest to strength and conditioning practitioners as training regimes must address these side-to-side asymmetries alongside the tailored programmes that are often prescribed to develop the posterior muscle groups.

This work fills an important gap in the literature. A methodology for the assessment of push symmetry in wheelchair propulsion was developed. Yet by conducting the study we note that the asymmetries may have been related to a difference in arm scores between sides, which unfortunately was information unavailable at the time but has become a recent topic of interest by classifiers. From our practical experience differences between arms becomes more evident higher up the classification spectrum and could be the focus of future work within WCR.

While over-ground pushing is the most ecologically valid method (van der Slikke et al., 2015), this research comprised of the wheelchair-user combination with rolling resistances that allowed the wheelchair velocities that would be achieved on a WCR court to be reproduced on the dual-roller system. The use of a wheelchair ergometer does provide a controlled environment for data collection. The PO profiles were indicative for high performance WCR players, yet we must appreciate the many limitations of using a wheelchair ergometer vs. over-ground propulsion or treadmill exercise (Vanlandewijck et al., 2001; Mason et al., 2014). That said, the use of the instrumented dual-roller ergometer highlights that asymmetries do exist; and these data could become useful to assist with our understanding to support both classifiers as well as the strength and conditioning practitioners guidance given to WCR players.

## Perspectives

The instrumented dual-roller ergometer enabled left and right asymmetries to be identified in experienced WCR players. The use of a 15s sprint seemed to be useful for the measurement of 28 m which is the length of a WCR court. As expected, HP players displayed faster sprint times, reached higher peak speeds and peak PO's than LP players. That said, the HP players did not necessarily use a technique with fewer pushes to cover the 28m. Our results support the assumption that asymmetry exists when propelling under strenuous sport-like conditions and these were evident in the HP group that comprised of players with SCI and other health conditions. Quantification of these asymmetries are important not only for the classifier, but for the sports practitioner wishing to improve performance as they could be addressed through training and/or wheelchair configuration.

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## Conflicts of interest

The authors declare no conflict of interest.

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## Figure Captions

Figure 1. Experimental set-up.

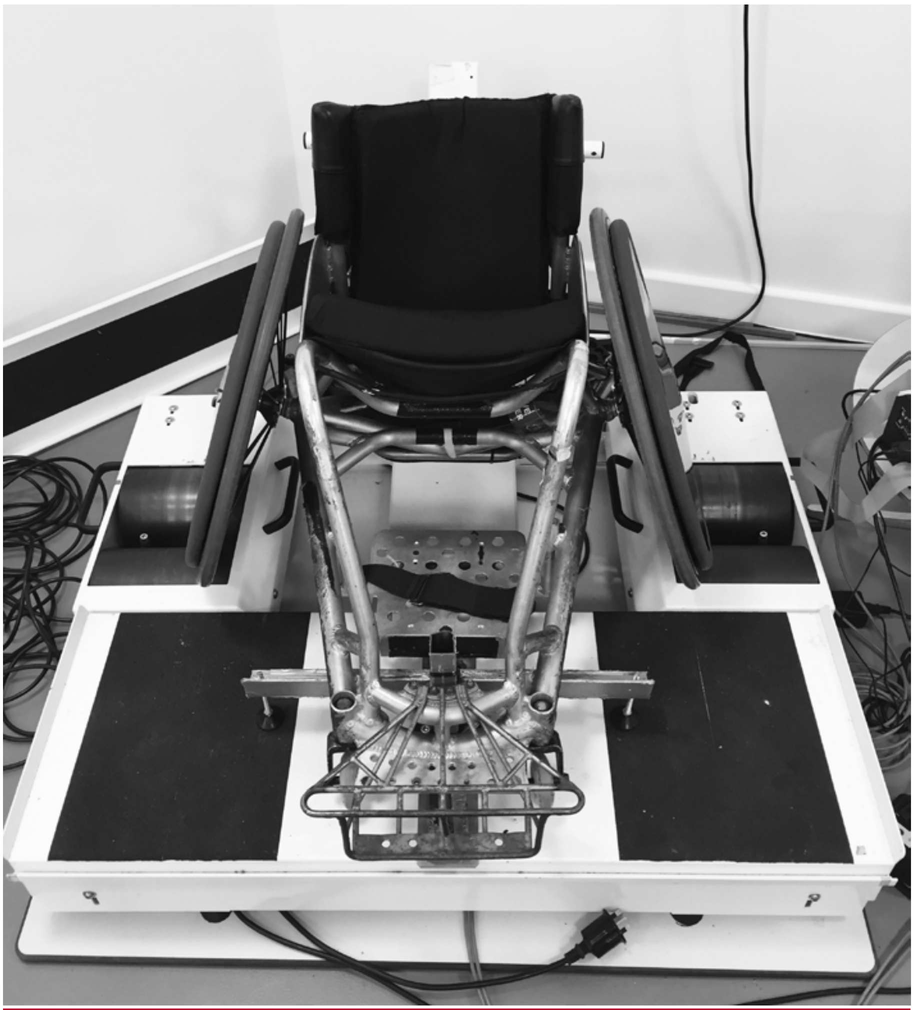
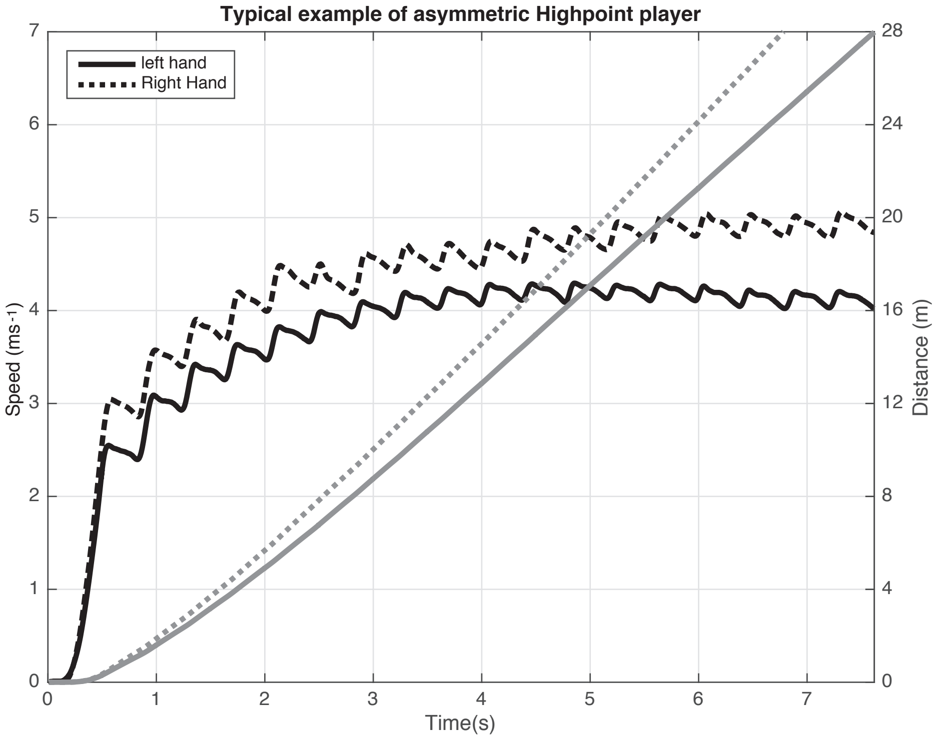


Figure 2.Typical example of the pushes across time of the left and right side during the sprint of a high-point (HP) player (left graph) and a sprint of a low-point (LP) player (right graph) and corresponding distances covered.


Typical example of asymmetric Highpoint player

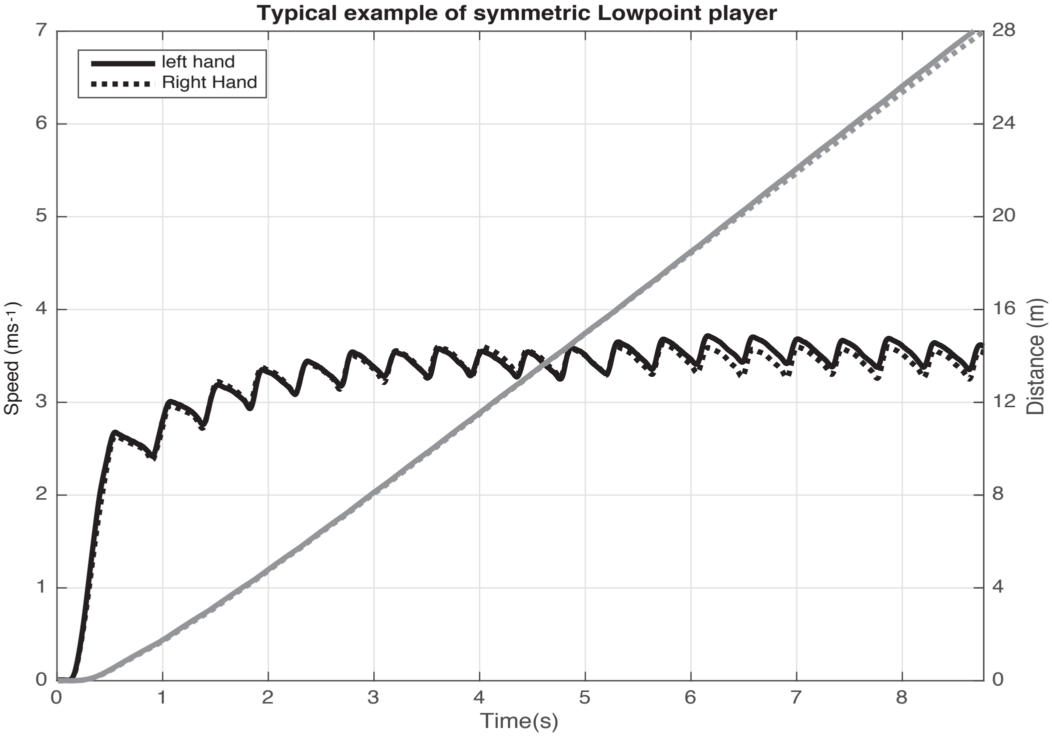
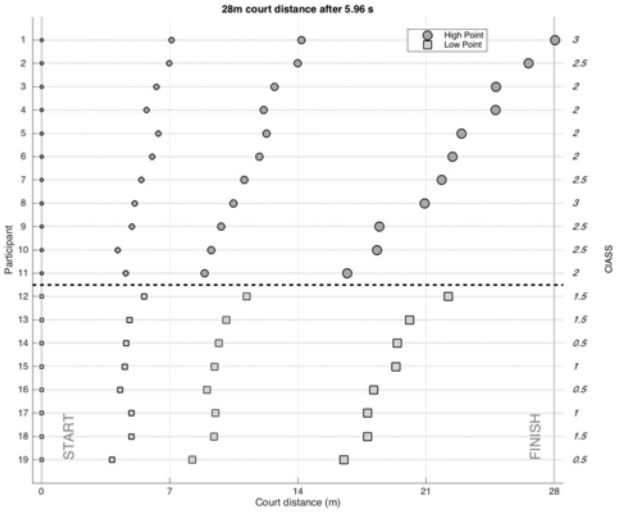

Typical example of symmetric Lowpoint player

Figure 3. a) Individual distances covered by the wheelchair rugby players at the time the best player finished the 28 m sprint; b) An illustration of the asymmetries which was defined as the difference between the distances achieved left and right when the best side reached 28m.


28m court distance after 5.96 s
High Point
Low Point
Participant
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
CIASS
3
2.5
2
2
2
2
2.5
3
2.5
2.5
2
1.5
1.5
0.5
1
0.5
1
1.5
0.5
START
FINISH
0
7
14
21
28
Court distance (m)

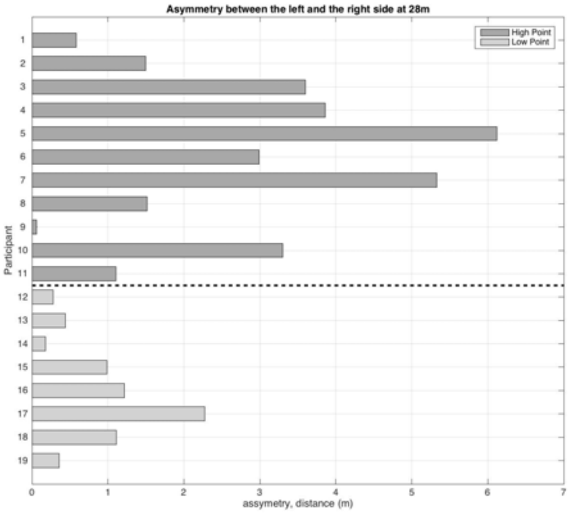
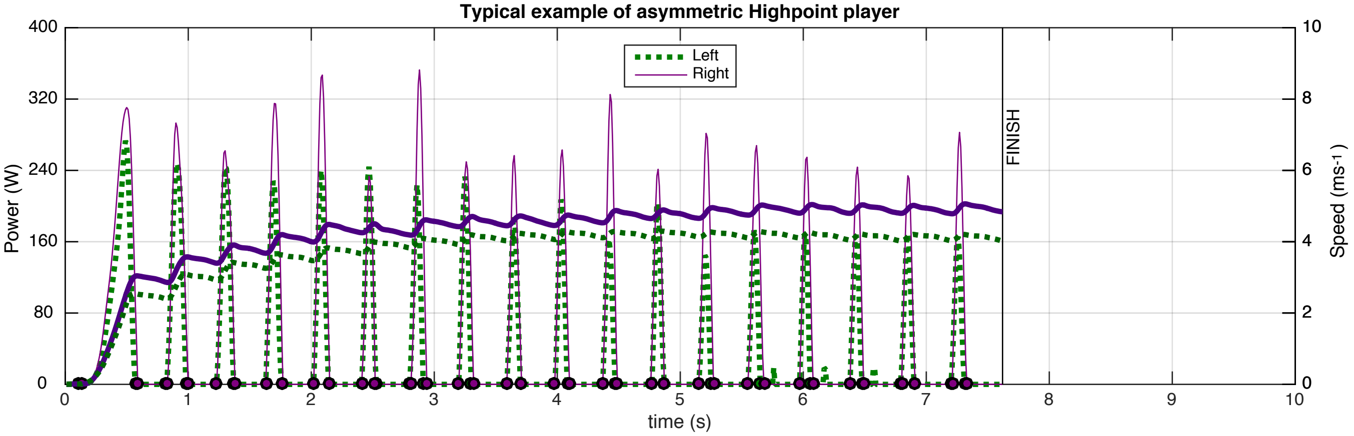
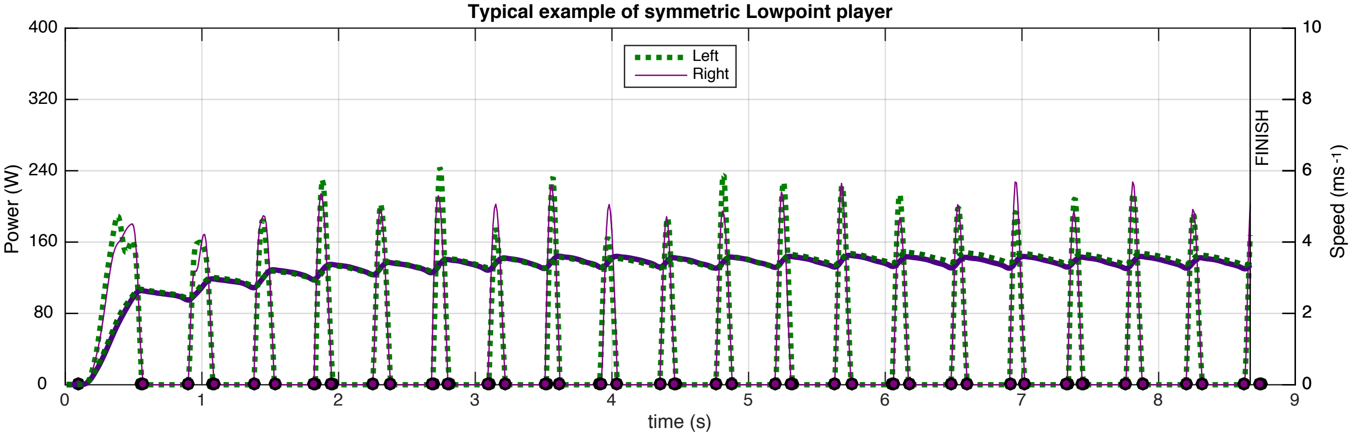

Asymmetry between the left and the right side at 28m
High Point
Low Point
Participant
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
0
1
2
3
4
5
6
7
assymetry, distance (m)

Figure 4: Typical example of the propulsion technique of the left and right side during the sprint of a high-point (HP) player (upper graph) and a sprint of a low-point (LP) player (lower graph).


Typical example of asymmetric Highpoint player


Typical example of symmetric Lowpoint player

## Tables

Table 1. Mean (standard deviation) of the propulsion technique variables (averaged left and right) and asymmetries between sides for the different groups (HP and LP) of elite WCR players

| | HP | LP | *P* | Effect size (± 90%CI) | Qualitative outcome |
|---|---|---|---|---|---|
| **Grouped data:** | | | | | |
| Frequency (Hz) | 2.56 (0.31) | 2.20 (0.22) | * | 1.30 (0.46 to 2.14) | Large |
| Push time (%) | 33.2 (3.0) | 38.1 (4.4) | ** | 1.35 (0.50 to 2.19) | Large |
| Contact angle (°) | 95.8 (19.2) | 109.0 (16.6) | N.S | 0.73 (-0.06 to 1.52) | Moderate |
| Work/push (J) | 19.5 (5.2) | 15.1 (2.3) | * | 1.04 (0.22 to 1.85) | Moderate |
| 28 m sprint time (s) | 6.95 (0.89) | 8.03 (0.68) | ** | 1.33 (0.49 to 2.18) | Large |
| Peak speed (m/s) | 4.80 (0.71) | 4.09 (0.45) | * | 1.15 (0.33 to 1.98) | Moderate |
| Peak speed after 3 cycles (m/s) | 3.76 (0.47) | 3.20 (0.30) | ** | 1.37 (0.52 to 2.22) | Large |
| Peak power (W) | 667 (108) | 357 (78) | ** | 3.20 (2.60 to 4.35) | Very large |
| Peak power after 3 cycles (W) | 632 (103) | 343 (67) | ** | 3.21 (2.07 to 4.36) | Very large |
| **Asymmetries:** | | | | | |
| Distance (m) | 1.86 (1.43) | 0.70 (0.65) | * | 0.99 (0.18 to 1.80) | Moderate |
| Peak speed (m/s) | 0.35 (0.25) | 0.11 (0.10) | ** | 1.21 (0.36 to 2.06) | Large |
| Relative peak speed (%) | 7.2 (5.0) | 2.5 (2.2) | ** | 1.17 (0.33 to 2.01) | Moderate |
| Peak speed after 3 cycles (m/s) | 0.23 | 0.13 | * | 1.04 | Moderate |

|  |  |  |  |  |  |
|---|---|---|---|---|---|
|  | (0.10) | (0.09) |  | (0.21 to 1.88) |  |
| Relative peak speed after 3 cycles (%) | 5.7<br>(2.5) | 3.9<br>(2.4) | N.S | 0.73<br>(-0.07 to 1.54) | Moderate |
| Peak power (W) | 32.6<br>(24.2) | 17.9<br>(8.2) | * | 0.78<br>(-0.03 to 1.59) | Moderate |
| Relative peak power (%) | 9.0<br>(6.7) | 9.2<br>(4.4) | N.S | 0.03<br>(-0.75 to 0.82) | Trivial |
| Peak power after 3 cycles (W) | 27.6<br>(17.5) | 14.8<br>(10.8) | N.S | 0.86<br>(0.04 to 1.67) | Moderate |
| Relative peak power after 3 cycles (%) | 8.3<br>(5.4) | 8.3<br>(6.2) | N.S | 0<br>(-0.78 to 0.78) | Trivial |

Note. * = $P<0.05$, ** = $P<0.01$ and N.S = non-significant difference ($P>0.05$)