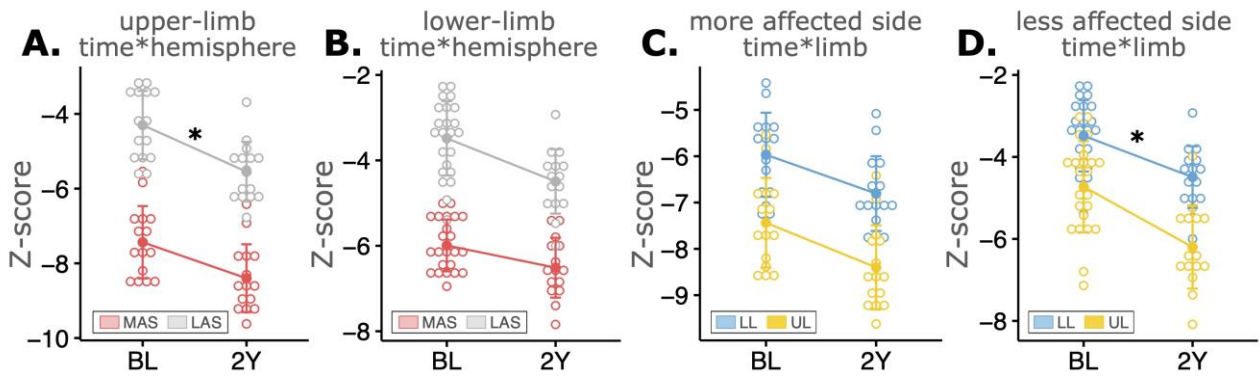
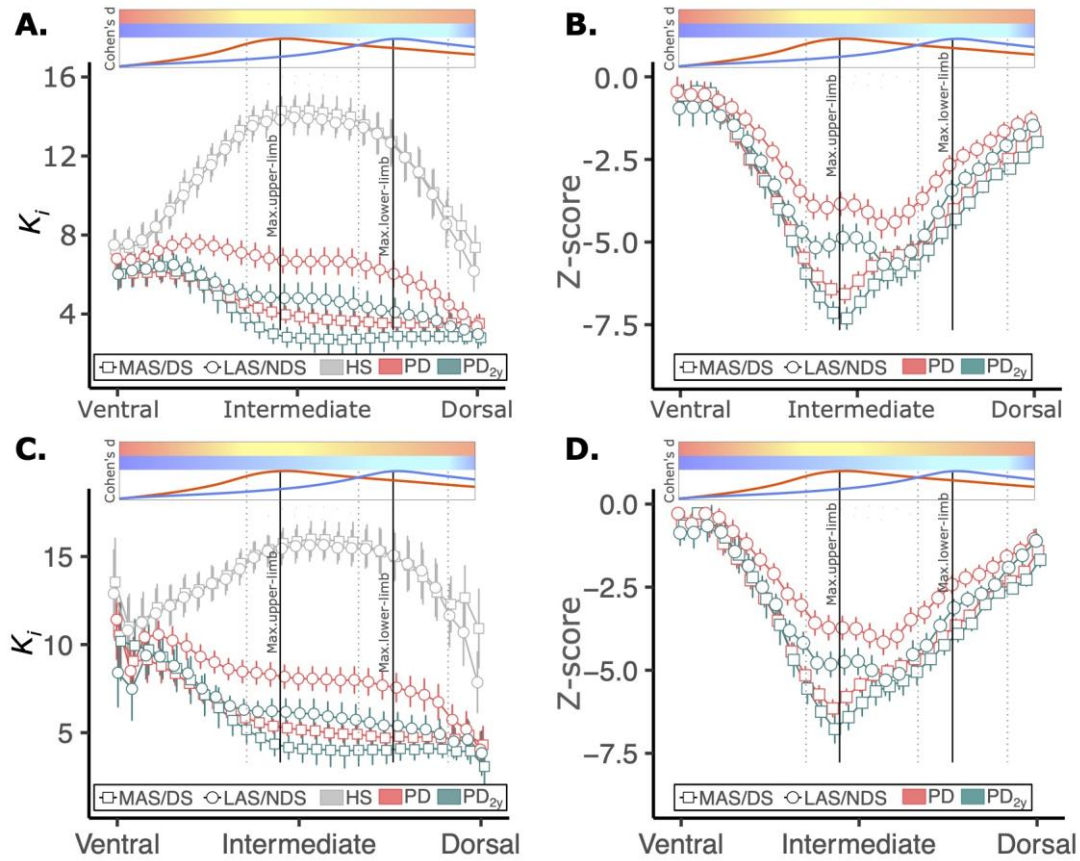


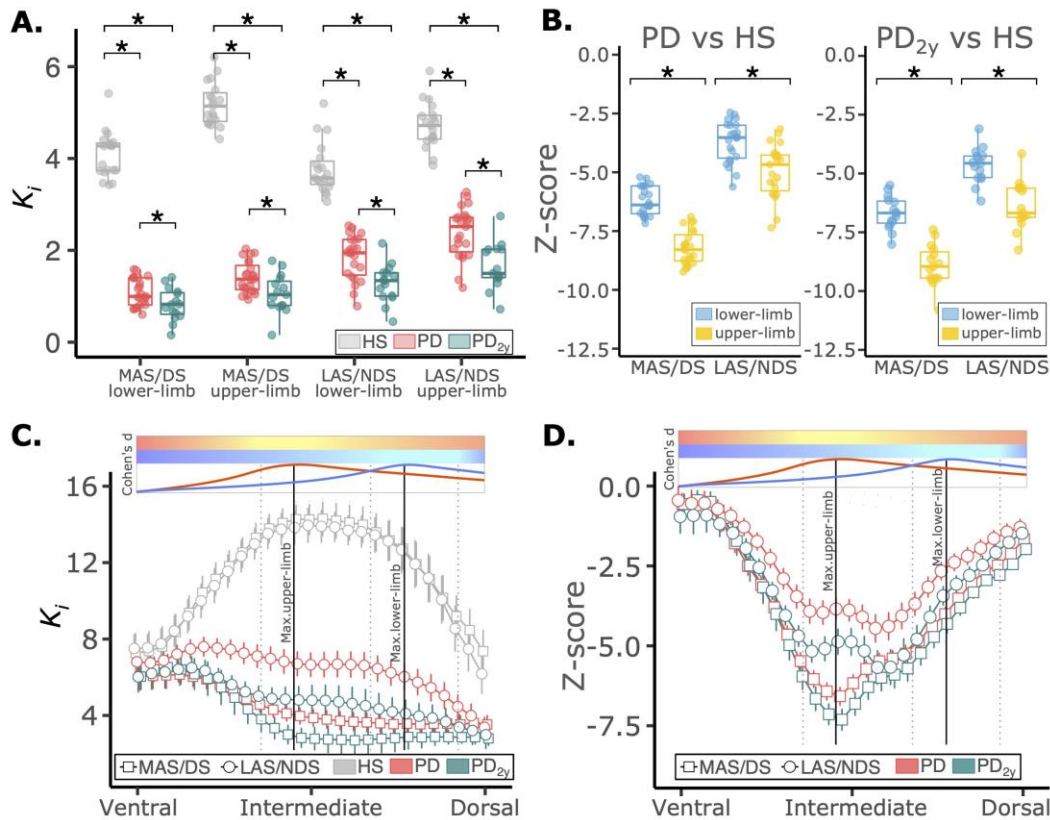
Supplementary material



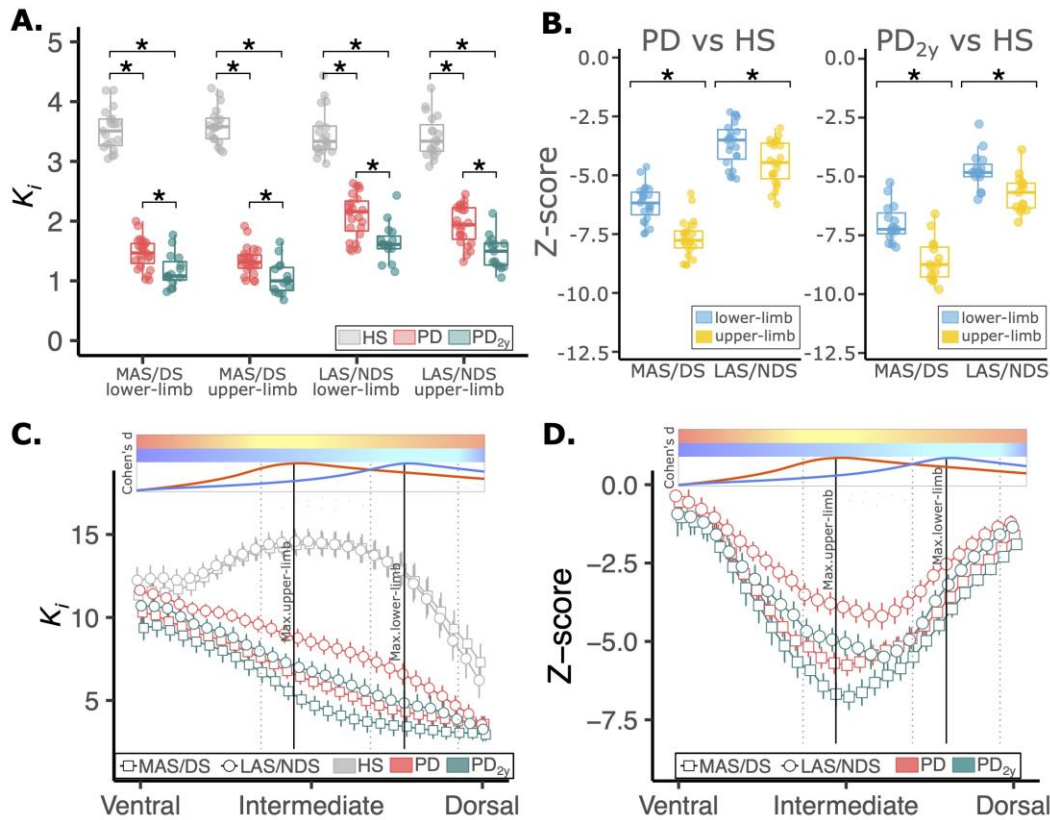
Supplementary Figure 1. Two-way interaction plots. Error-bars (average value and standard deviation) and jittered data distribution for all tested interactions. From left to the right: **A.** time by brain side in the upper-limb. **B.** time by brain side in the lower-limb. **C.** time by region of interest in the more affected side. **D.** time by region of interest in the less affected side. (*) stands for significant interaction after two-way repeated measures ANOVA with P-value < 0.05.



Supplementary Figure 2. Slice-wise analysis of ^{18}F -DOPA images in the posterior putamen without (**A.** - **B.**) and with (**C.** - **D.**) partial volume error correction. **A.** and **C.** Error bars show K_i slice-wise averages and confidence intervals (95%) in the post-commissural putamen from the most ventral to the most dorsal extent for HS (grey), PD at baseline (red), and at 2 years follow-up (green) on both more affected and less affected sides. **B.** and **D.** Error bars show Z-scores (average and confidence interval) for K_i in PD normalized to HS, in the more affected (squares) and less affected (circles) sides. PD at baseline is represented in red and PD at 2 years follow-up in green. In all sub-figures two-color bars represent the fMRI normalized activation along the dorsoventral axis for the upper (red to yellow) and lower (dark blue to light blue) limbs. Below the colorbars two normalized curves show the strength of the group activation map along the dorsoventral axis. Maxima have been highlighted downwards with vertical lines. In dotted vertical lines the interval between the 75% of the maximum activation are also highlighted.



Supplementary Figure 3. Region-based analysis of ^{18}F -DOPA uptake rates in the post-commissural putamen. A. Boxplots show weighted-average K_i values (median and perc_{25-75}) for HS (grey) and PD at baseline (red) and at 2 year follow-up (green). K_i values in the post-commissural putamen contralateral the more affected or less affected side (MAS/LAS) were weighted by the strength (Cohen's d) of the upper and lower limb group activation fMRI maps and averaged. * $P < 0.001$ with Mann Whitney U test. **B.** Boxplots show Z-scores for K_i weighted-average values (median and perc_{25-75}) normalized to HS for upper (yellow) and lower limb (light blue). * $P < 0.001$ with Wilcoxon signed-rank test. **C.** Error bars show K_i slice-wise averages and confidence intervals (95%) in the post-commissural putamen from the most ventral to the most dorsal extent for HS (grey), PD at baseline (red) and at 2 year follow-up (green) on both the more affected and less affected sides. **D.** Error bars show Z-scores (average and confidence interval) for K_i in PD normalized to HS, on the more affected (squares) and less affected (circles) sides. PD at baseline is represented in red and PD at 2 year follow-up in green. In **C** and **D** two color bars represent the fMRI normalized activation along the dorsoventral axis for the upper (red to yellow) and lower (dark blue to light blue) limbs. Below the colorbars two normalized curves show the strength of the group activation map along the dorsoventral axis. Maxima have been highlighted downwards with vertical lines. In dotted vertical lines the interval between the 75% of the maximum activation are also highlighted.



Supplementary Figure 4. Region-based analysis of ^{18}F -DOPA uptake rates in the whole putamen. **A.** Boxplots show weighted-average K_i values (median and perc₂₅₋₇₅) for HS (grey) and PD at baseline (red) and at 2 year follow-up (green). K_i values in the whole putamen contralateral the more affected or less affected side (MAS/LAS) were weighted by the strength (Cohen's d) of the upper and lower limb group activation fMRI maps and averaged. * $P < 0.001$ with Mann Whitney U test. **B.** Boxplots show Z-scores for K_i weighted-average values (median and perc₂₅₋₇₅) normalized to HS for upper (yellow) and lower limb (light blue). * $P < 0.001$ with Wilcoxon signed-rank test. **C.** Error bars show K_i slice-wise averages and confidence intervals (95%) in the whole putamen from the most ventral to the most dorsal extent for HS (grey), PD at baseline (red) and at 2 year follow-up (green) on both the more affected and less affected sides. **D.** Error bars show Z-scores (average and confidence interval) for K_i in PD normalized to HS, on the more affected (squares) and less affected (circles) sides. PD at baseline is represented in red and PD at 2 year follow-up in green. In **C** and **D** two color bars represent the fMRI normalized activation along the dorsoventral axis for the upper (red to yellow) and lower (dark blue to light blue) limbs. Below the colorbars two normalized curves show the strength of the group activation map along the dorsoventral axis. Maxima have been highlighted downwards with vertical lines. In dotted vertical lines the interval between the 75% of the maximum activation are also highlighted.

Supplementary Table 1. ^{18}F -DOPA uptake rates corresponding to putaminal hand and foot fMRI group activations. *P*-values after non-parametric with Wilcoxon signed-rank test evaluating pair-wise differences for ^{18}F -DOPA K_i weighted-average values between hand and foot functional divisions. Weighted averages are shown for the whole putamen (3rd column) and for the post-commissural putamen (5th column). Reported values are represented as median and interquartile ranges.

Group	ROI	K_i weighted average (putamen)	<i>P</i> -value (Foot vs Hand)	K_i weighted average (posterior putamen)	<i>P</i> -value (Foot vs Hand)
HS	DS-Foot	3.51 [3.27-3.71]	<i>P</i> = 0.0663	4.27 [3.74-4.34]	<i>P</i> < 0.001
	DS-Hand	3.58 [3.38-3.72]		5.14 [4.81-5.43]	
	NDS-Foot	3.33 [3.20-3.59]	<i>P</i> > 0.05	3.58 [3.44-3.94]	<i>P</i> < 0.001
	NDS-Hand	3.34 [3.17-3.61]		4.72 [4.42-4.94]	
PD _{BL}	MAS-Foot	1.47 [1.29-1.63]	<i>P</i> < 0.001	1.00 [0.81-1.40]	<i>P</i> < 0.001
	MAS-Hand	1.31 [1.21-1.43]		1.37 [1.15-1.67]	
	LAS-Foot	2.16 [1.84-2.34]	<i>P</i> < 0.001	1.95 [1.46-2.24]	<i>P</i> < 0.001
	LAS-Hand	1.94 [1.70-2.22]		2.52 [1.97-2.72]	
PD _{2y}	MAS-Foot	1.08 [1.02-1.32]	<i>P</i> < 0.001	0.82 [0.61-1.08]	<i>P</i> < 0.001
	MAS-Hand	1.00 [0.84-1.22]		1.04 [0.80-1.33]	
	LAS-Foot	1.61 [1.54-1.75]	<i>P</i> < 0.001	1.34 [1.00-1.51]	<i>P</i> < 0.001
	LAS-Hand	1.50 [1.27-1.63]		1.50 [1.41-2.02]	