

Supplementary imaging results

PD-females vs HC-females (Supplementary Table 2)

Compared to HC-females, PD-females showed decreased FC between the right sensorimotor ROI and the bilateral substantia nigra; decreased FC between the right sensorimotor ROI and the left precentral gyrus; increased FC between the right sensorimotor ROI and the anterior cingulate cortex (ACC); decreased FC between the left sensorimotor ROI and the cingulate gyrus and between the left sensorimotor ROI and left precentral gyrus.

Compared to HC-females, PD-females showed increased FC between the left limbic ROI and the right superior temporal gyrus (STG) and between the left limbic ROI and the left middle occipital gyrus (MOG); increased connectivity between the right limbic ROI and the left inferior frontal gyrus and between the right limbic ROI and the brainstem.

Compared to HC-females, PD-females showed increased FC between the left cognitive ROI and the left and right and left STG; increased FC between the right cognitive ROI and the left STG; decreased FC between the right cognitive ROI and the right and left inferior parietal lobule.

PD-males vs HC-males (Supplementary Table 2)

Compared to HC-males, PD-males showed increased FC between the left sensorimotor ROI and the right cuneus; increased FC between the right sensorimotor ROI and the right fusiform gyrus and between the right sensorimotor ROI and the bilateral cuneus; decreased FC between the right sensorimotor ROI and the cingulate cortex.

Compared to HC-males, PD-males showed decreased FC between the left limbic ROI and right middle frontal gyrus (MFG); increased FC between the left limbic ROI and the right insula and between the right limbic ROI and the right postcentral gyrus.

Compared to HC-males, PD-males showed increased FC between the left cognitive ROI and the left transverse temporal gyrus; decreased FC between the left cognitive ROI and the right MFG and between the left cognitive ROI and the right medial frontal gyrus; increased FC between the right

cognitive ROI and the right cuneus; decreased FC between the right cognitive ROI and the right medial frontal gyrus.

HC-females vs HC-males (Supplementary Table 2)

Compared to HC-males, HC-females showed decreased FC between the right sensorimotor ROI and the right superior occipital gyrus and between the right sensorimotor ROI and the ACC; increased FC between the right sensorimotor ROI and the bilateral cuneus and between the right sensorimotor ROI and the bilateral motor cortex; increased FC between the left sensorimotor ROI and the left STG and between the left sensorimotor ROI and the right motor cortex.

Compared to HC-males, HC-females showed increased FC between the left limbic ROI and the right motor cortex; decreased FC between the right limbic ROI and the ACC; increased FC between the right limbic ROI and the right middle temporal gyrus and between the right limbic ROI and the right precuneus.

Compared to HC-males, HC-females showed increased FC between the left cognitive ROI and the right motor cortex; decreased FC between the left cognitive ROI and the ACC, and between the left cognitive ROI and the left MOG; increased FC between the right cognitive ROI and the left and right motor cortex; decreased FC between the right cognitive ROI and the ACC.

Supplementary Table 1. Summary of the significant ROI-based functional connectivity differences between the study groups from the three striatal subregions (i.e. sensorimotor, cognitive and limbic).

	PD-males mean $\pm$ SD (n=84)	PD-females mean $\pm$ SD (n=63)	HCS mean $\pm$ SD (n=38)	PD-males vs HCS p-value	PD-females vs HCS p-value	PD-males vs PD-females p-value
Brain region (coordinates)						
<i>Left sensorimotor striatal ROI</i>						
Left SFG (x=-22; y=24; z=47)	-0.0 $\pm$ 0.2	-0.2 $\pm$ 0.2	-	-	-	<0.001
Left substantia nigra (x=-6; y=-13; z=-6)	0.1 $\pm$ 0.2	-	0.3 $\pm$ 0.3	<0.001	-	-
Left SFG (x=-5; y=55; z=24)	-	-0.2 $\pm$ 0.14	-0.1 $\pm$ 0.2	-	<0.001	-
Right SFG (x=21; y=63; z=6)	-	-0.2 $\pm$ 0.2	-0.0 $\pm$ 0.1	-	<0.001	-
<i>Right sensorimotor striatal ROI</i>						
Left Substantia nigra (x=-5; y=-14; z=-6)	0.1 $\pm$ 0.0	-	0.2 $\pm$ 0.0	<0.001	-	-
CG (x=-5; y=9; z=29)	0.0 $\pm$ 0.0	-	0.2 $\pm$ 0.0	<0.001	-	-
Left fusiform gyrus (x=-27; y=-78; z=-12)	-	-0.0 $\pm$ 0.2	-0.1 $\pm$ 0.2	-	<0.001	-
Right fusiform gyrus (x=39; y=-71; z=-12)	-	-0.0 $\pm$ 0.2	-0.2 $\pm$ 0.2	-	<0.001	-
Left Substantia nigra (x=-5; y=-14; z=-6)	-	0.1 $\pm$ 0.2	0.3 $\pm$ 0.2	-	<0.001	-
Left STG (x=-47; y=-14; z=0)	-	0.2 $\pm$ 0.2	0.1 $\pm$ 0.2	-	<0.001	-
<i>Left limbic striatal ROI</i>						
Right insula (x=41; y=-13; z=6)	0.2 $\pm$ 0.2	-	0.0 $\pm$ 0.2	<0.001	-	-
Right MFG (x=39; y=50; z=9)	-0.1 $\pm$ 0.2	-	0.0 $\pm$ 0.1	<0.001	-	-
Right IFG (x=22; y=35; z=-7)	0.0 $\pm$ 0.2	-	0.2 $\pm$ 0.2	<0.001	-	-
Right MFG (x=33; y=41; z=16)	-	-0.07 $\pm$ 0.15	0.1 $\pm$ 0.2	-	<0.001	-
Right IFG (x=22; y=32; z=-8)	-	0.1 $\pm$ 0.2	0.3 $\pm$ 0.2	-	<0.001	-
Right SFG (x=3; y=14; z=55)	-	-0.1 $\pm$ 0.1	0.1 $\pm$ 0.2	-	<0.001	-
ACC (x=-15; y=35; z=19)	-	0.2 $\pm$ 0.2	0.3 $\pm$ 0.2	-	<0.001	-
<i>Right limbic striatal ROI</i>						
Right MFG (x=36; y=46; z=12)	-0.0 $\pm$ 0.1	-	0.1 $\pm$ 0.2	<0.001	-	-
Left STG (x=-52; y=-7; z=-10)	0.1 $\pm$ 0.1	-	-0.0 $\pm$ 0.2	<0.001	-	-
ACC (x=-14; y=42; z=7)	0.3 $\pm$ 0.2	-	0.4 $\pm$ 0.2	<0.001	-	-
Right MFG (x=32; y=40; z=16)	-	-0.0 $\pm$ 0.1	0.1 $\pm$ 0.2	-	<0.001	-
Left IFG (x=-18; y=27; z=-10)	-	0.1 $\pm$ 0.1	0.3 $\pm$ 0.2	-	<0.001	-
Right IFG (x=22; y=22; z=-10)	-	0.1 $\pm$ 0.1	0.3 $\pm$ 0.2	-	<0.001	-
Right Hippocampus (x=31; y=-26; z=-5)	-	0.1 $\pm$ 0.1	-0.1 $\pm$ 0.2	-	<0.001	-
ACC (x=-3; y=34; z=16)	-	0.1 $\pm$ 0.1	0.2 $\pm$ 0.1	-	<0.001	-
<i>Left cognitive striatal ROI</i>						
Right insula (x=41; y=-15; z=4)	0.1 $\pm$ 0.2	-	-0.0 $\pm$ 0.2	<0.001	-	-
Left insula (x=-40; y=-15; z=4)	-	0.2 $\pm$ 0.2	0.0 $\pm$ 0.2	-	<0.001	-
Right SFG (x=5; y=30; z=49)	-	0.0 $\pm$ 0.1	0.1 $\pm$ 0.1	-	<0.001	-
Left IFG (x=-22; y=21; z=-13)	-	0.0 $\pm$ 0.1	0.1 $\pm$ 0.1	-	<0.001	-
Right IFG (x=29; y=30; z=-9)	-	-0.0 $\pm$ 0.2	0.1 $\pm$ 0.2	-	<0.001	-
<i>Right cognitive striatal ROI</i>						
Left insula (x=-41; y=-8; z=4)	0.2 $\pm$ 0.2	-	0.0 $\pm$ 0.2	-	<0.001	-
Right insula (x=44; y=-15; z=4)	0.2 $\pm$ 0.2	-	0.0 $\pm$ 0.2	-	<0.001	-
Left IFG (x=-22; y=21; z=-13)	-0.0 $\pm$ 0.1	-	0.1 $\pm$ 0.1	-	<0.001	-
Right IFG (x=22; y=22; z=-11)	-0.0 $\pm$ 0.1	-	0.1 $\pm$ 0.2	-	<0.001	-

P-values refer to pairwise T-test. Abbreviations. Parkinson's disease; HCS= healthy controls; ROI= region of interest; ACC= anterior cingulate cortex; CG= cingulate cortex; PD=; IFG= inferior frontal gyrus; MFG= middle frontal gyrus; SFG= superior frontal gyrus; STG= superior temporal gyrus; SD= standard deviation.

Supplementary Table 2. Summary of the significant ROI-based functional connectivity differences between PD-males and HC-males, PD-females and HC-females, HC-males and HC-females from the three striatal subregions (i.e. sensorimotor, cognitive and limbic).

	PD-males mean $\pm$ SD (n=84)	PD-females mean $\pm$ SD (n=63)	HC-males mean $\pm$ SD (n=18)	HC-females mean $\pm$ SD (n=20)	PD-males vs HC- males p-value	PD-females vs HC- females p-value	HC-males vs HC- females p-value
Brain region (coordinates)							
<i>Left sensorimotor striatal ROI</i>							
Right cuneus (x=6; y=-85; z=28)	0.1 $\pm$ 0.0	-	-0.1 $\pm$ 0.0	-	<0.001	-	-
CG (x=-9; y=-16; z=40)	-	0.1 $\pm$ 0.0	-	0.3 $\pm$ 0.0	-	<0.001	-
Left postcentral gyrus (x=-57; y=-22; z=31)	-	0.1 $\pm$ 0.0	-	0.2 $\pm$ 0.0	-	<0.001	-
Left STG (x=-60; y=-19; z=7)	-	-	0.1 $\pm$ 0.0	0.2 $\pm$ 0.0	-	-	<0.001
Right STG (x=42; y=-46; z=16)	-	-	-0.0 $\pm$ 0.0	-0.2 $\pm$ 0.0	-	-	<0.001
Right MFG (x=27; y=14; z=58)	-	-	-0.0 $\pm$ 0.0	-0.2 $\pm$ 0.0	-	-	<0.001
Right motor cortex (x=31 y=-39; z=60)	-	-	-0.0 $\pm$ 0.0	0.1 $\pm$ 0.0	-	-	<0.001
<i>Right sensorimotor striatal ROI</i>							
Right fusiform gyrus (x=42; y=-67; z=-11)	-0.1 $\pm$ 0.0	-	-0.2 $\pm$ 0.0	-	<0.001	-	-
Right cuneus (x=6; y=-85; z=28)	0.1 $\pm$ 0.0	-	-0.1 $\pm$ 0.0	-	<0.001	-	-
CG (x=-3; y=8; z=28)	0.0 $\pm$ 0.0	-	0.2 $\pm$ 0.0	-	<0.001	-	-
Right substantia nigra (x=9; y=-17; z=-7)	-	0.2 $\pm$ 0.1	-	0.4 $\pm$ 0.0	-	<0.001	-
ACC (x=3; y=26; z=-2)	-	-0.0 $\pm$ 0.0	-	-0.2 $\pm$ 0.0	-	<0.001	-
Left precentral gyrus (x=-39; y=-17; z=42)	-	0.1 $\pm$ 0.0	-	0.3 $\pm$ 0.0	-	<0.001	-
Right SOG (x=40; y=-77; z=29)	-	-	-0.0 $\pm$ 0.0	-0.2 $\pm$ 0.0	-	-	<0.001
Medial frontal gyrus (x=2; y=-22; z=55)	-	-	0.0 $\pm$ 0.0	0.2 $\pm$ 0.0	-	-	<0.001
ACC (x=-3; y=48; z=9)	-	-	-0.0 $\pm$ 0.0	-0.2 $\pm$ 0.0	-	-	<0.001
Left cuneus (x=0; y=-82; z=13)	-	-	-0.1 $\pm$ 0.0	0.1 $\pm$ 0.0	-	-	<0.001
<i>Left limbic striatal ROI</i>							
Right insula (x=39; y=-10; z=7)	0.2 $\pm$ 0.0	-	0.0 $\pm$ 0.0	-	<0.001	-	-
Right MFG (x=24; y=44; z=-8)	-0.0 $\pm$ 0.0	-	0.2 $\pm$ 0.0	-	<0.001	-	-
Right postcentral gyrus (x=21; y=-31; z=46)	0.0 $\pm$ 0.0	-	-0.1 $\pm$ 0.0	-	<0.001	-	-
Right STG (x=48; y=-10; z=-7)	-	0.0 $\pm$ 0.0	-	-0.1 $\pm$ 0.0	-	<0.001	-
Left MOG (x=-30; y=-88; z=13)	-	-0.0 $\pm$ 0.0	-	-0.2 $\pm$ 0.1	-	<0.001	-
Right motor cortex (x=26; y=-41; z=59)	-	-	-0.1 $\pm$ 0.0	0.0 $\pm$ 0.0	-	-	<0.001
<i>Right limbic striatal ROI</i>							
Right MTG (x=47; y=-60; z=-2)	-0.0 $\pm$ 0.0	-	-0.2 $\pm$ 0.0	-	<0.001	-	-
Right MFG (x=24; y=41; z=-11)	-0.0 $\pm$ 0.0	-	0.2 $\pm$ 0.0	-	<0.001	-	-
Right precentral gyrus (x=29; y=-28; z= 48)	0.1 $\pm$ 0.0	-	-0.1 $\pm$ 0.0	-	<0.001	-	-
Left medial frontal gyrus (x=-12; y=41; z= 13)	0.1 $\pm$ 0.0	-	0.3 $\pm$ 0.0	-	<0.001	-	-
Brainstem (x=-3; y=-22; z=-35)	-	-0.0 $\pm$ 0.0	-	-0.2 $\pm$ 0.0	-	<0.001	-
Left IFG (x=-58; y=17; z=10)	-	-0.0 $\pm$ 0.0	-	-0.2 $\pm$ 0.0	-	<0.001	-
Right precuneus (x=1; y=-51; z=50)	-	-	-0.1 $\pm$ 0.0	0.1 $\pm$ 0.0	-	-	<0.001
Right MTG (x=44; y=-58; z=-2)	-	-	-0.2 $\pm$ 0.0	0.0 $\pm$ 0.0	-	-	<0.001
ACC (x=0; y=48; z=20)	-	-	0.1 $\pm$ 0.0	-0.0 $\pm$ 0.0	-	-	<0.001
<i>Left cognitive striatal ROI</i>							
Right MFG (x=27; y=38; z=-11)	-0.1 $\pm$ 0.0	-	0.1 $\pm$ 0.0	-	<0.001	-	-
Right SFG (x=9; y=55; z=-18)	-0.1 $\pm$ 0.0	-	0.0 $\pm$ 0.0	-	<0.001	-	-
Transverse temporal gyrus (x=-60 y=-19; z=7)	0.1 $\pm$ 0.0	-	-0.1 $\pm$ 0.0	-	<0.001	-	-
Left STG (x=-38; y=1; z=-11)	-	0.1 $\pm$ 0.0	-	-0.1 $\pm$ 0.1	-	<0.001	-
Right STG (x=47; y=7; z=-10)	-	0.1 $\pm$ 0.0	-	-0.1 $\pm$ 0.0	-	<0.001	-
Right motor cortex (x=42; y=-37; z=58)	-	-	-0.1 $\pm$ 0.0	0.0 $\pm$ 0.0	-	-	<0.001
ACC (x=6; y=43; z=10)	-	-	0.2 $\pm$ 0.0	-0.0 $\pm$ 0.0	-	-	<0.001
Left MOG (x=-33; y=-91; z=10)	-	-	0.0 $\pm$ 0.0	-0.2 $\pm$ 0.0	-	-	<0.001
<i>Right cognitive striatal ROI</i>							
Left medial frontal gyrus (x=-12; y=44; z=16)	0.0 $\pm$ 0.0	-	0.2 $\pm$ 0.0	-	<0.001	-	-
Right cuneus (x=6; y=-85; z=28)	0.1 $\pm$ 0.0	-	-0.1 $\pm$ 0.1	-	<0.001	-	-
Left STG (x=-42; y=9; z=-11)	-	0.2 $\pm$ 0.0	-	-0.0 $\pm$ 0.1	-	<0.001	-
Right STG (x=48; y=-4; z=-11)	-	0.1 $\pm$ 0.0	-	-0.1 $\pm$ 0.0	-	<0.001	-
Left IPL (x=-32; y=-51; z=40)	-	-0.1 $\pm$ 0.0	-	0.1 $\pm$ 0.0	-	<0.001	-
Right IPL (x=42; y=-46; z=40)	-	-0.0 $\pm$ 0.0	-	0.1 $\pm$ 0.0	-	<0.001	-
Left motor cortex (x=-29; y=-36; z=49)	-	-	-0.1 $\pm$ 0.0	0.1 $\pm$ 0.0	-	-	<0.001
Right motor cortex (x=30; y=-35; z=49)	-	-	-0.1 $\pm$ 0.0	0.1 $\pm$ 0.0	-	-	<0.001
ACC (x=1; y=44; z=25)	-	-	0.1 $\pm$ 0.0	-0.0 $\pm$ 0.0	-	-	<0.001

P-values refer to pairwise T-test. Abbreviations. Parkinson's disease; HC= healthy controls; ROI= region of interest; ACC= anterior cingulate cortex; CG= cingulate cortex; IFG= inferior frontal gyrus; IPL= inferior parietal lobule; MFG= middle frontal gyrus; MTG=

middle temporal gyrus; MOG= middle occipital gyru; SFG= superior frontal gyrus; ITG= inferior temporal gyrus; SOG=superior occipital gyrus; STG= superior temporal gyrus; SD= standard deviation.