

Supplementary Materials for

Evidence for precision grasping in Neandertal daily activities

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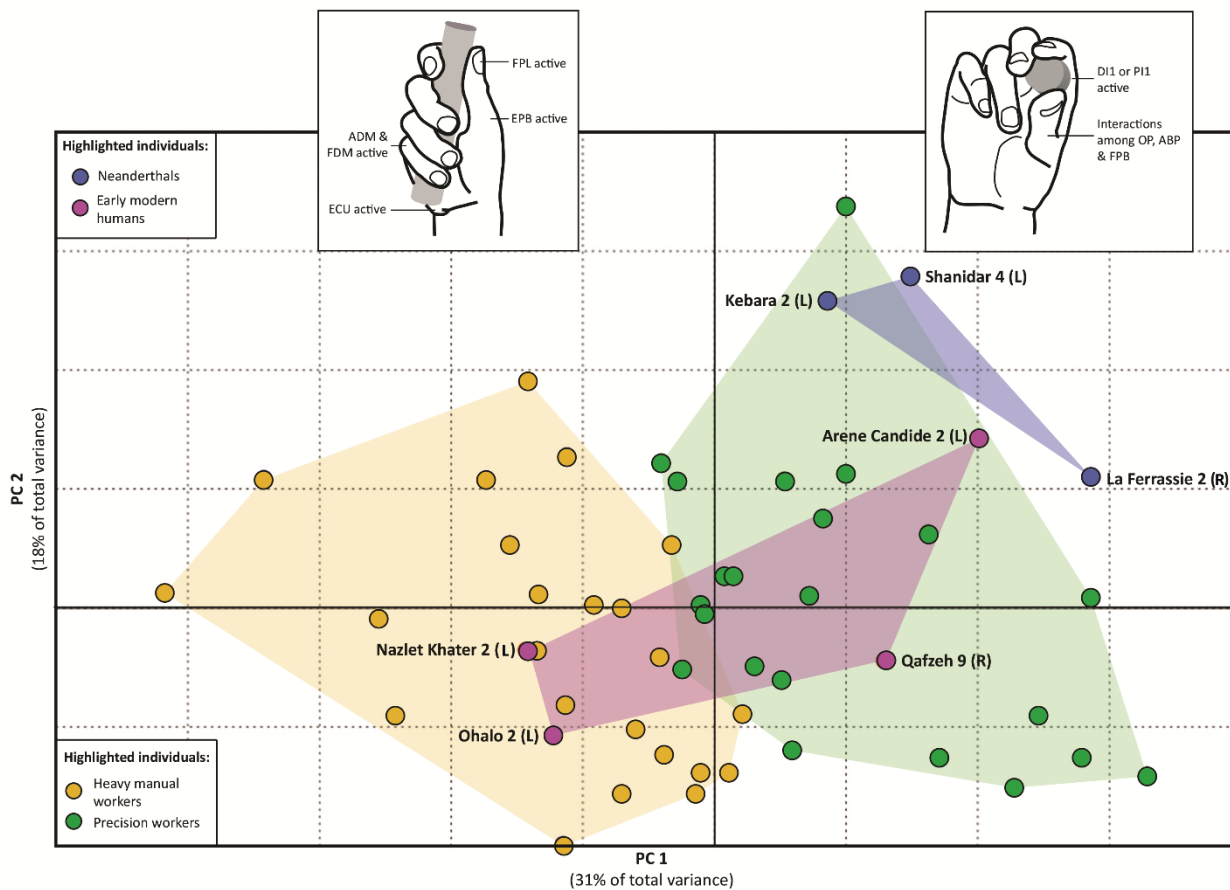


Fig. S1. PCA using eight entheses from the same anatomical side of each fossil, either left (L) or right (R), and the right side of the reference specimens, PC1 versus PC2. The two side figures demonstrate muscle entheses with high factor loadings, which describe the two opposite enthesal patterns of PC1.

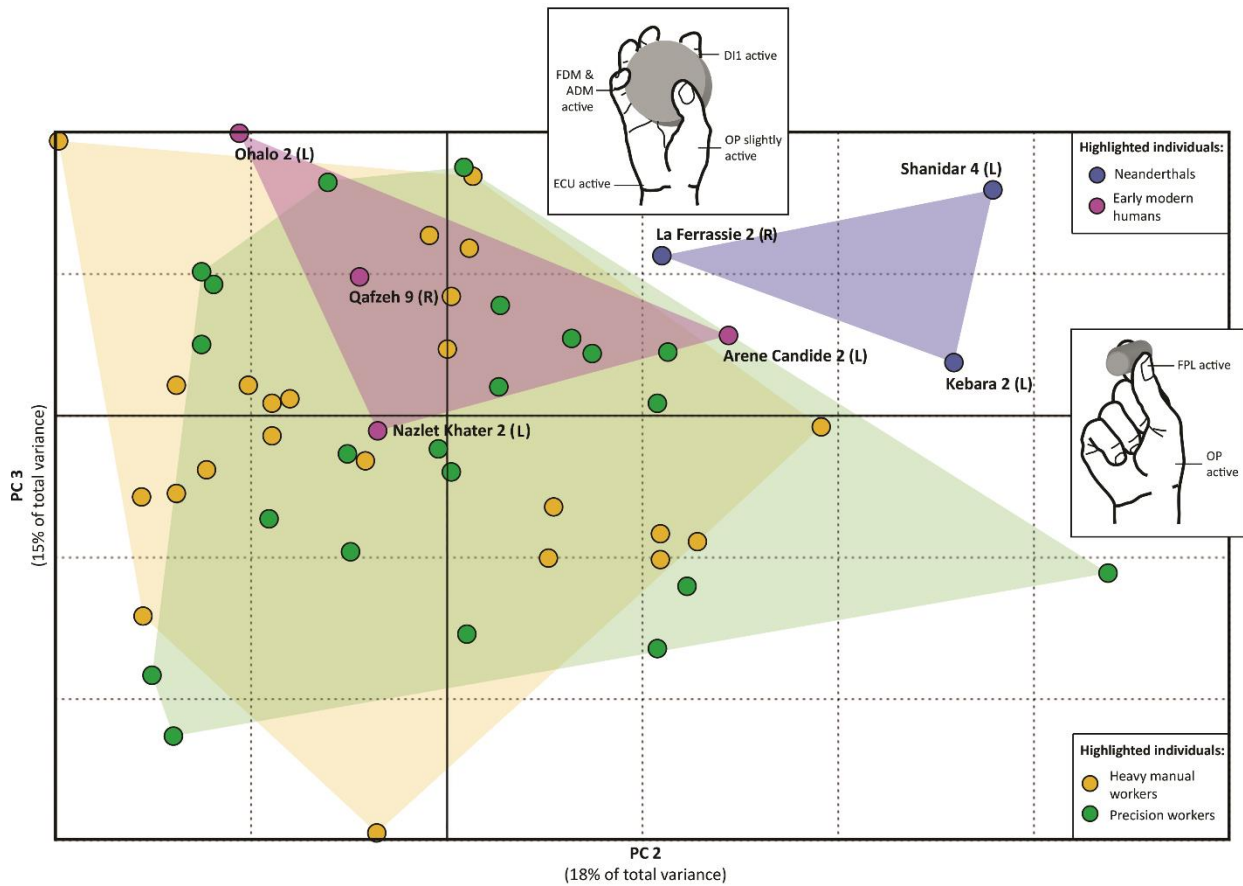


Fig. S2. PCA using eight entheses from the same anatomical side of each fossil, either left (L) or right (R), and the right side of the reference specimens, PC2 versus PC3. The two side figures demonstrate muscle entheses with high factor loadings, which describe the enthesal pattern separating Neanderthals from all modern humans (i.e., high values both in PC2 and PC3).

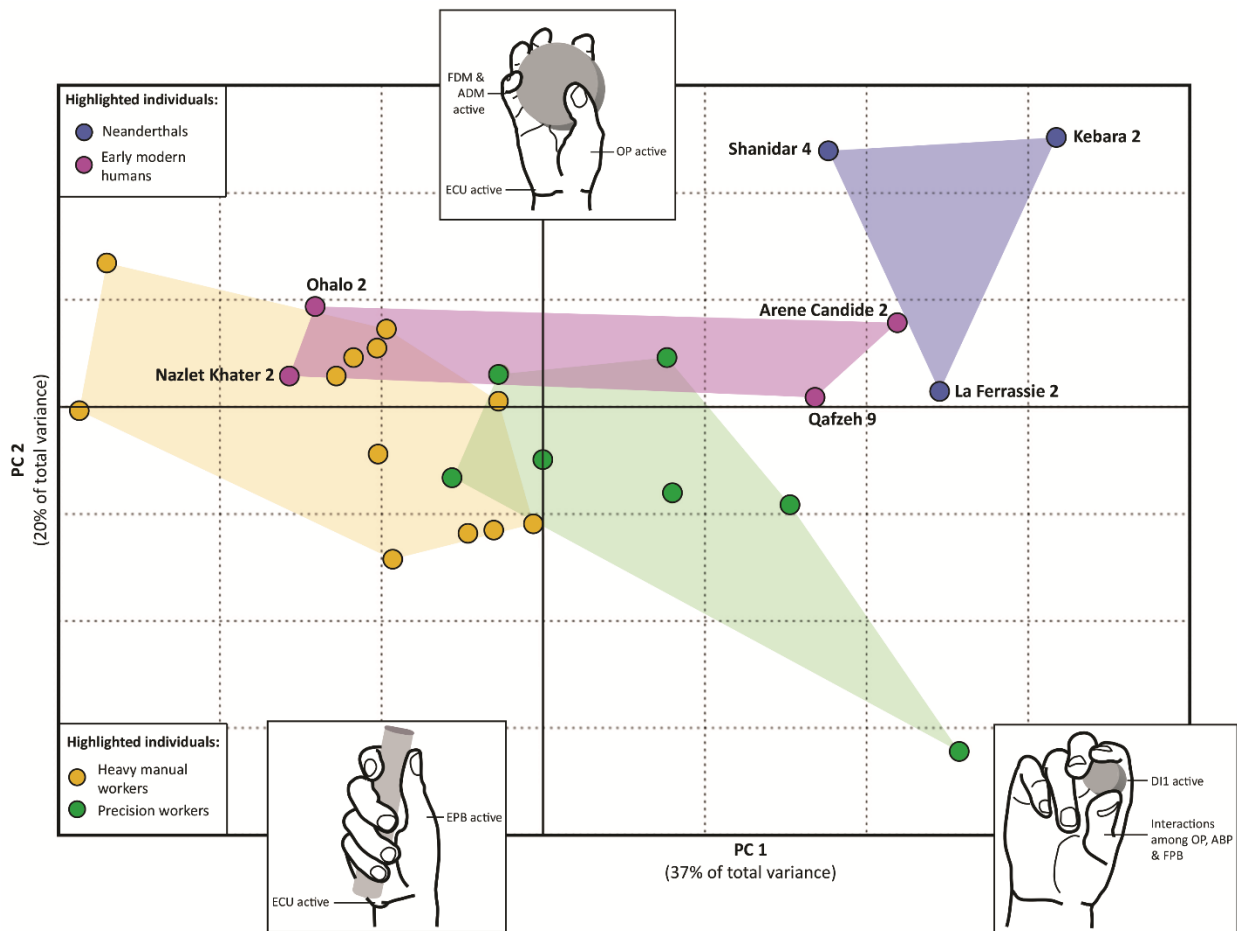


Fig. S3. PCA using seven entheses from the same anatomical side of each fossil and the left side of the reference specimens, PC1 versus PC2. The side figures demonstrate muscle entheses with high factor loadings, which describe the two opposite enthesal patterns of PC1 and the pattern of Neanderthals on PC3.

Table S1. Individual hand bone sets comprising the fossil samples. The information presented in this table for each specimen derives from the references cited in the second column.

Species	Individual hand bone set	Sex	Location	Date	Cultural association
Neanderthals	Kebara 2 (56)	Male	Near East	64-56 ka	Mousterian
	La Ferrassie 1 (57)	Male	Europe	45-43 ka	Mousterian
	La Ferrassie 2 (57)	Female	Europe	45-43 ka	Mousterian
	Shanidar 3 (58)	Male	Near East	75-50 ka	Mousterian
	Shanidar 4 (58)	Male	Near East	100-75 ka	Mousterian
	Tabun 1 (59)	Female	Near East	138-106 ka	Mousterian
Early modern humans	Abri Pataud 1 (60)	Female	Europe	28-26 ka	Gravettian
	Arene Candide 2 (38)	Male	Europe	11.8-10.9 ka	Epigravettian
	Dolni Vestonice 14 (61)	Male	Europe	26.6 ka	Gravettian
	Nazlet Khater 2 (35)	Male	North Africa	44-32 ka	Nazlet Khater 4 industry
	Ohalo 2 (62)	Male	Near East	<i>circa 19 ka</i>	Kebaran
	Qafzeh 9 (63)	Female	Near East	130-100/92 ka	Mousterian

Table S2. Descriptive statistics for the size-adjusted enthesal surface area measurements of the fossil specimens.

Bone	Measurements ^{1,2}	<u>Neanderthals</u>			<u>Modern humans</u>		
		Mean	Standard error of the mean	Standard Deviation	Mean	Standard error of the mean	Standard Deviation
First proximal phalanx	ABP / FPB	1.46	0.03	0.07	1.39	0.12	0.31
	ADP	1.41	0.10	0.24	1.15	0.13	0.31
	EPB	0.50	0.03	0.08	0.73	0.10	0.26
Second proximal phalanx	DI1	1.54	0.11	0.23	1.70	0.09	0.30
	PI1	0.92	0.11	0.21	1.10	0.04	0.08
Fifth proximal phalanx	ADM / FDM	1.25	0.11	0.22	1.21	0.09	0.19
First metacarpal	OP	1.39	0.11	0.22	0.91	0.08	0.15
Fifth metacarpal	ECU	1.61	0.07	0.15	1.47	0.11	0.21
First distal phalanx	FPL	0.55	0.08	0.15	0.55	0.04	0.09

¹ABP / FPB: *abductor pollicis / flexor pollicis brevis*, ADP: *adductor pollicis*, EPB: *extensor pollicis brevis*, DI1: *first dorsal interosseus*, PI1: *first palmar interosseus*, ADM / FDM: *abductor digiti minimi / flexor digiti minimi*, OP: *opponens pollicis*, ECU: *extensor carpi ulnaris*, FPL: *flexor pollicis longus*.

²Each enthesal measurement in this column is represented by the name of its corresponding muscle. In two cases, the same enthesal area is associated with two muscles (ABP / FPB and ADM / FDM).

Table S3. Eigenvalues and factor loadings of the four PCAs on size-adjusted enthesal surface measurements.

Principal component analyses ¹	Principal component	Eigenvalue	% of variance	Factor loadings ²								
				OP	ABP/FPB	ADP	EPB	FPL	DI1	PI1	ADM/FDM	ECU
1st	PC 1	2.51	31.34	0.63	0.78	–	–0.67	–0.44	0.52	0.39	–0.31	–0.62
	PC 2	1.44	17.97	0.62	0.03	–	–0.56	0.49	–0.59	–0.28	0.04	0.25
	PC 3	1.23	15.38	0.21	< 0.01	–	–0.11	–0.56	0.29	–0.44	0.65	0.4
	Total		64.69									
2nd	PC 1	2.59	36.98	0.8	0.77	–	–0.86	–	0.35	0.21	< 0.01	–0.68
	PC 2	1.43	20.4	0.4	–0.20	–	–0.34	–	–0.40	–0.40	0.82	0.35
	Total		57.38									
3rd	PC 1	2.75	30.52	0.63	0.8	0.57	–0.70	–0.35	0.44	0.21	–0.33	–0.64
	PC 2	1.65	18.37	0.48	–0.06	0.41	–0.45	0.51	–0.63	–0.52	0.16	0.28
	PC 3	1.34	14.87	0.19	< 0.01	–0.10	–0.16	–0.63	0.33	–0.38	0.7	0.35
	Total		63.76									
4th	PC 1	2.17	72.26	–	0.73	0.82	–0.98	–	–	–	–	–
	Total		72.26									

¹1st: eight entheses, same anatomical side of each fossil, right side of the comparative sample;

2nd: seven entheses, same anatomical side of each fossil, left side of the comparative sample; 3rd:

all nine entheses, mixed sides fossil dataset, right side of the comparative sample (best preserved);

4th: three entheses from the same anatomical side of each fossil, right side of the comparative sample.

²Factor loadings over 0.30 (51) are in bold.

Table S4. Statistics of the two discriminant function analyses.

Discriminant function analyses	Precision-grip group accuracy (original / cross-validated)	Power-grip group accuracy (original / cross-validated)	Group centroids (precision / power groups)	Unstandardized coefficients			Constant
				Principal component 1	Principal component 2	Principal component 3	
1st (mixed-sides dataset of nine entheses)	95.5% / 90.9%	95.7% / 95.7%	- 1.28 / 1.33	1.7	0.58	0.312	0.28
2nd (dataset of three entheses)	91.3% / 91.3%	100% / 100%	- 1.10 / 1.15	1.79	-	-	0.41