Supplementary Materials: Experimental One-Sided Choppers Relating Neuro-Muscular Human Abilities to Heart Rates and Technological Evolution

Igor Parra [1,*], Luisa Morales [2,3], Javier Mar [4,5,6] and Eudald Carbonell [1,7]

Table S1. Values in the database containing each experimental chopper associated with its manufacturing quantified tempos, in seconds. All these data have been used for a statistical ANOVA test (see S4).

xp1	1.15	2.30	3.50	**4.70**	6.20	
xp2	1.03	2.06	3.09	4.12	5.21	6.23
xp3	1.15	2.30	3.50	4.70	5.85	7.00
xp4	1.15	2.30	3.45	4.60	6.10	
xp5	0.90	1.80	2.70	3.60	4.28	
xp6	1.00	2.00	3.00	4.00	5.00	
xp7	1.03	1.98	2.93	3.88	4.83	5.86
xp8	1.03	2.03	3.03	4.03	5.03	6.03
xp9	1.00	2.00	3.00			
xp10	1.00	2.00	3.00	4.00		
xp11	1.00	2.00	3.00	4.00	5.00	
xp12	1.00	2.00	3.00	4.00		
xp13	1.00	2.00	3.00			
xp14	0.75	1.50	2.21	2.93		
xp15	0.75	1.50	2.25	2.93	3.68	4.43
xp16	0.71	1.42	2.13			
xp17	0.68	1.36	2.04			
xp18	0.68	1.36	2.01	2.66	3.31	
xp19	0.65	1.30	1.95			
xp20	0.75	1.50	2.25			
xp21	0.71	1.42	2.13			
xp22	0.71	1.43	2.14	2.86		
xp23	0.68	1.36	2.04			
xp24	0.71	1.43	2.14	2.86		
xp25	0.68	1.36	2.04			

xp26	0.65	1.31	1.97							
xp27	0.62	1.24	1.86							
xp28	0.72	1.44	2.16							
xp29	0.68	1.36	2.72	3.40						
xp30	0.68	1.36	2.72							
xp31	0.65	1.30	1.95							
xp32	0.68	1.36	2.04							
xp33	0.71	1.42	2.13							
xp34	0.75	1.50	2.25	3.00	3.75	4.50	6.00	6.75		
xp35	0.71	1.43	2.14	2.86	3.57	4.28	5.71	6.43	7.14	
xp36	0.68	1.36	2.04	2.72	3.41	4.09				
xp37	0.66	1.33	1.99	2.65	3.31	3.97	5.29	5.95	6.61	
xp38	0.65	1.30	1.96	2.60	3.26	3.91				
xp39	0.60	1.20	1.80	2.40	3.00	3.60	4.80			
xp40	0.63	1.25	1.88	2.50	3.13	3.75	5.00	5.63		
xp41	0.60	1.20	1.80	2.40	3.00	3.60	4.80	5.40	6.00	6.60
xp42	0.87	1.70	2.60	3.47	4.35	5.21	6.93	7.79	8.64	
xp43	1.03	2.06	3.09	4.12	5.12	6.12				
xp44	0.75	1.50	2.25	3.00	3.75	4.50				
xp45	0.68	1.36	2.04	2.72						
xp46	0.71	1.42	2.13	2.84						
xp47	0.60	1.20	1.80	2.40	3.00	3.60	4.92	5.58	6.24	6.90
xp48	0.71	1.42	2.13	2.48	3.19					
xp49	0.71	1.42	2.13	2.84						
xp50	0.65	1.30	1.95	2.60	3.25					
xp51	0.65	1.30	1.95	2.63	3.31	4.09				
xp52	0.71	1.42	2.13	2.81	3.49	4.17				
xp53	0.65	1.30	1.95							
xp54	0.63	1.25	1.87	2.49	3.11					
xp55	0.65	1.30	1.95	2.60						
xp56	broken									
xp57	0.68	1.36	2.04							
xp58	0.75	1.50	2.25	2.96	3.67					
xp59	0.83	1.66	2.49	3.27	4.05					

xp60	0.68	1.36	2.72	3.40						
xp61	0.71	1.42	2.13	2.84						
xp62	0.65	1.30	1.95	2.60	3.25					
xp63	0.65	1.30	1.95	2.60						
xp64	0.71	1.42	2.13							
xp65	0.78	1.56	2.34	3.12	3.90	4.68	5.46			
xp66	0.71	1.42	2.13	2.84	3.55	4.26	4.97			
xp67	0.78	1.56	2.34							
xp68	broken									
xp69	broken									
xp70	0.85	1.70	2.55	3.40						
xp71	broken									
xp72	0.83	1.66	2.49							
xp73	0.83	1.66	2.49							
xp74	broken									
xp75	0.83	1.66	2.49							
xp76	broken									
xp77	0.75	1.50	2.25							
xp78	0.78	1.56	2.34	3.12						
xp79	0.87	1.74	2.57	3.40						
xp80	0.75	1.52	2.27	3.02						
xp81	0.75	1.52	2.27							
xp82	0.71	1.42	2.13							
xp83	1.20	2.40	3.60	4.80	5.40	6.00				
xp84	1.20	1.80	2.40	3.60						
xp85	1.20	2.40	3.00	4.02	5.40	6.60	8.40	9.60	10.20	10.80
xp86	1.25	2.50	3.13	3.75	4.38	5.00	7.50			
xp87	1.20	2.40	3.60	4.80	6.00	7.20	8.40	9.00	9.60	
xp88	broken									
xp89	1.20	2.40	3.60	4.80	6.00	7.20	9.60	10.80	11.40	12.00
xp90	broken									
xp91	1.15	2.30	3.45	4.03	4.61	5.76	6.92	7.50	8.08	
xp92	broken									
xp93	1.00	2.00	2.90	3.80	4.70	5.60	7.40	7.85	8.30	

xp94	1.00	2.00	3.00	4.00	5.00	6.00	8.00	9.50	10.00	10.95
xp95	0.95	1.90	2.77	3.64	4.59	5.54	7.44			
xp96	0.95	1.90	2.85	3.35	3.85	4.60	6.41	7.31	8.14	8.97
xp97	1.00	1.95	2.90	3.80	4.75					
xp98	0.90	1.80	2.63	3.46	4.29					
xp99	0.83	1.66	2.49	3.32	4.15	4.98	6.64	7.47	8.30	9.13
xp100	0.90	1.80	2.70	3.53	3.94	4.84	6.57	7.40		
xp101	0.83	1.66	2.49	3.32	4.15	4.98	6.64	7.47	8.30	9.13

Drawings of experimental choppers #1 and #2 show a good morpho-technical fit with one side old choppers found at archaeological sites. These very simple one side lithic tools, both experimental and old ones, display a cutting edge used as for smashing as for cutting bones and plants.

Table S2: ANOVA test : differences in number of blows, total time, and mean time per blow based on knapper expertise.

Expertise		Number of blows	Total time	Mean time/blow
No expertise	Mean	8,06	8,00	0,98
	N	16	16	16
	Standard deviation	2,11	2,41	0,10
Expert	Mean	4,68	3,70	0,78
	N	76	76	76
	Standard deviation	1,84	1,64	0,14
Total	Mean	5,27	4,45	0,82
	N	92	92	92
	Standard deviation	2,27	2,42	0,16
ANOVA		p<,001	p<,001	p<,001

Table S3: experimental sites, level of expertise of experimental knappers, hammer raw material and experimental choppers numbered as they are shown at Table SM1

11/14/2008	Tarragona	Expert subject A	1 quartzite hammer	choppers 1 to 6
3/2/2009	Tarragona	Expert subject A	2 limestones hammers 2 quartzite hammers	choppers 7 to 15 choppers 16 to 24
6/3/2009	Atapuerca	Expert subject A	1 limestone hammer 3 quartzite hammers	choppers 25 to 57 choppers 58 to 82
6/4/2009	Atapuerca	Non expert subject B	1 quartzite hammer	choppers 83 to 92
6/4/2009	Atapuerca	Non expert subject B	1 quartzite hammer	choppers 93 to 101

Table S4: Values in the database containing inverse normal Gaussian distribution for HHR and experimental strikes of each one-sided chopper.

Times Heartbeats	Times Heartbeats	Times Heartbeats	Times Heartbeats	Times Heartbeats
0.8517	0.8826	1.0383	0.7661	0.8032
0.9619	0.9194	0.8542	0.8028	0.9617
0.8404	0.7873	0.8866	0.8393	1.2
0.8088	1.0233	0.9036	0.7677	0.9146
0.8541	1.0414	0.8293	0.8534	0.7851
0.8628	0.9265	1.2693	0.7946	0.7486
1.0055	0.9834	0.8277	0.9714	0.9279
0.9832	1.1956	1.4207	1.0128	0.7789
0.8473	0.769	0.7383	0.7275	0.7347
1.0266	0.8044	0.9318	0.8042	1.0497
0.9456	0.7587	0.8147	0.9712	1.0309
0.7695	0.8812	0.8745	0.7282	1.3714
0.7305	0.8232	0.7413	0.8153	0.9631
0.9432	0.957	0.8289	0.8481	0.841
0.8705	0.8665	0.742	0.8009	1.0614
0.8507	1.0426	0.92	0.8935	0.6642
0.9274	1.0238	0.8119	0.8092	0.978
0.9809	0.8915	0.7883	1.1596	0.989

0.7616	0.85	0.7321	1.0451	0.8944
0.7995	0.8721	0.8397	1.0001	0.7477
0.8269	0.7797	0.862	0.8388	1.0465
0.6479	0.8205	0.7242	0.9326	0.8169
0.9178	0.6811	0.8729	0.9647	1.1035
0.8831	0.7077	0.8614	1.1092	0.7568
0.9095	0.7948	0.8064	0.8781	0.9773
0.891	0.7726	0.9796	0.8916	0.7596
0.7803	0.9936	0.8371	0.7755	0.8644
0.7844	1.0629	0.7453	0.8878	0.9317
0.8421	0.8778	0.8105	0.8676	0.7357
0.7106	0.9814	0.8138	1.0374	0.9241
0.9286	1.2967	0.877	0.8201	1.0681
0.6817	0.8709	1.0223	0.8992	0.9456
0.8817	0.8079	0.9525	0.8507	1.0532
0.886	0.7671	0.6564	0.7207	0.7504
0.7635	0.8432	0.8471	0.9367	0.7015
0.9257	0.8013	0.9092	0.8318	0.9573
1.068	1.2486	0.861	0.8518	0.6451
1.0992	1.1148	0.898	0.7993	0.9436
0.904	0.9029	0.9043	0.6714	1.1712
0.936	1.1181	0.9399	0.9044	0.7778
1.0611	0.9922	0.7071	0.8277	0.8844
0.8479	0.8899	1.1083	0.8227	1.0038
0.6459	0.9904	1.1911	0.9188	0.6492
0.8765	1.0213	1.0257	0.8181	1.1864
0.8357	0.8312	0.7125	0.7908	1.2305
1.0166	0.7901	1.2419	0.783	0.8446
0.8594	0.8939	0.896	0.9098	0.9902
0.7751	0.8276	0.9311	0.9065	0.9068
1.041	0.7066	0.8227	0.9596	1.0549
1.012	0.7406	0.7149	0.925	0.8401
1.0934	0.7465	0.9343	1.2681	0.7877
0.8471	0.9257	0.835	0.7806	0.8613

0.7242	0.8463	0.8521	0.8954	0.9971
0.8003	0.9036	0.9836	0.9268	0.8945
1.0539	0.7105	0.7011	0.988	0.807
0.7647	0.7511	0.9705	0.9417	0.8537
0.919	0.9465	0.8097	0.9567	0.7609
1.007	0.7407	1.1449	0.8865	0.703
1.5055	0.8403	0.8336	0.6997	0.8731
0.8294	0.9335	1.0647	0.8884	0.7029
1.1009	0.8007	0.921	0.8533	1.1502
0.8803	0.809	0.9534	0.7808	
0.853	0.9333	1.02	1.184	
0.8464	0.8028	0.8386	0.8989	
0.8387	0.6736	0.9046	0.8633	
0.7986	0.7943	1.013	0.9099	
1.2285	0.9281	1.169	0.8106	
0.6903	0.8904	0.8287	0.8131	
1.0115	0.9351	1.0912	0.6799	
0.8837	0.9387	0.9038	1.0031	
0.8183	0.7808	1.0465	0.7363	
1.0458	1.1761	0.9088	1.1179	
0.8159	0.6592	0.9089	0.9758	
0.8497	0.8126	0.8316	0.9285	
0.786	0.8446	0.8441	1.0512	
0.7245	1.1898	1.017	0.7441	
1.0125	0.957	0.8307	0.7695	
0.7029	1.0115	1.0545	0.9545	
0.7902	0.8887	0.9836	0.9867	
0.9089	0.7185	0.685	0.9445	
0.8635	0.9323	0.9016	0.9048	
0.8772	0.9412	0.9637	0.7077	
0.8728	0.9821	0.8805	0.7883	
0.6971	0.8084	0.9661	0.7762	
0.9528	0.8393	0.8874	0.7839	
0.8156	0.7188	1.0112	0.7949	

0.943	0.9831	1.1723	0.9587
0.706	0.7158	0.8708	0.7779
0.6112	1.0348	0.6665	0.7318
0.7216	0.8963	1.0293	0.8584
0.7815	0.8609	0.7159	0.9202
0.8258	0.922	0.8238	0.7865
0.9964	0.8516	1.1611	0.7645
0.9073	1.0998	1.1006	0.7758
0.828	1.2657	0.7611	0.7533
0.7962	1.0461	0.7591	0.8881
0.6267	1.0393	0.8054	0.8313
0.7899	0.7424	0.8596	0.836
0.7771	0.9551	0.8496	0.8174
0.8294	0.9619	1.0496	0.7994
0.9245	0.8919	0.7473	0.8772
1.019	0.9251	0.7815	1.0465
0.834	1.1073	0.9259	0.9096
0.9619	0.8688	0.8557	0.8713
0.9703	0.9656	0.95	0.8947
0.8279	0.983	1.0751	1.2365

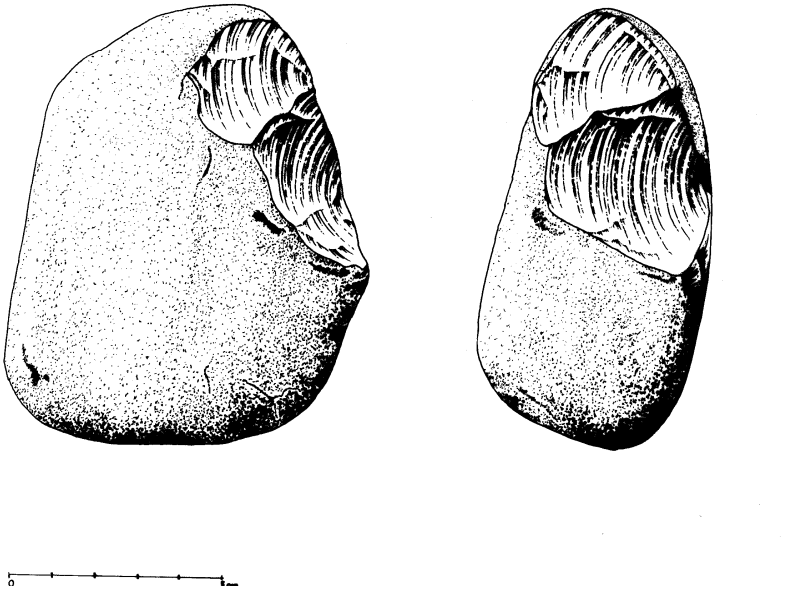

Figure S1 experimental chopper 1

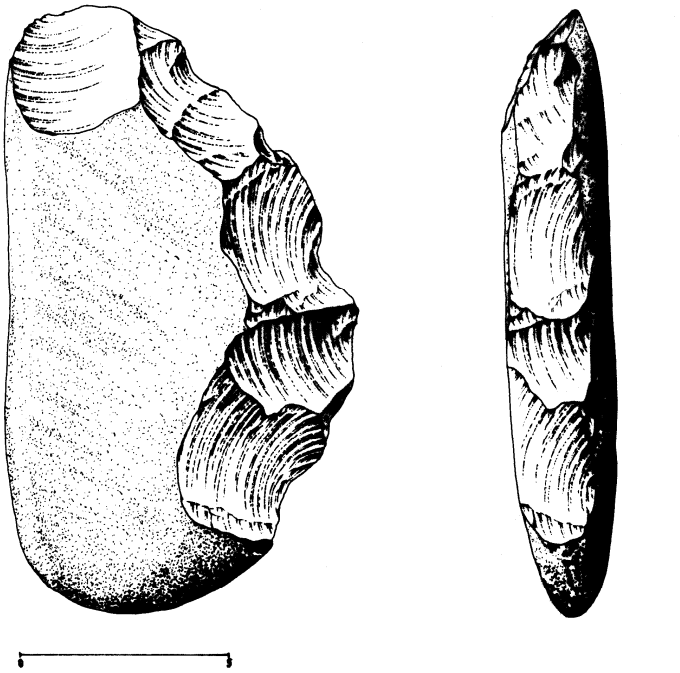

Figure S2 experimental chopper 2