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Novel Insights Into the Wisdom of Crowds by Process-Consistent Modeling

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- We propose to measure the weighting of various exogenous sources of information (e.g., advice A) in individual i's final judgment F by estimating **Mixed-Effects Regression Weights of Advice (MER-WOA) ω** from multilevel models that explicitly specify this **temporal contingency** of updating initial judgments I.
- In contrast to the traditional **Ratio-of-Differences (ROD)** weighting index of Harvey and Fischer (1997), MER-WOA specifies how strongly updated judgments were influenced by external evidence, implementing a **conceptually consistent** representation of the endogenous judgment process.
- This process-consistent modeling framework is used to **reinvestigate empirical findings** related to the wisdom of crowds, such as **algorithm appreciation** (Logg et al., 2019, Experiment 4), **sequential collaboration** (Mayer and Heck, 2022, Experiments 1 & 2), and **multiple advice taking** (Molleman et al., 2020).
- MER-WOA opens new avenues for **innovative research**, has the potential to increase the **reproducibility and replicability** of behavioral science, and is relevant also for **related cognitive phenomena** such as anchoring effects, hindsight bias, attitude change, or multidimensional belief updating.

Algorithm Appreciation

Definition: Integrating algorithmic advice more than quantitatively equivalent human advice (Logg et al., 2019)

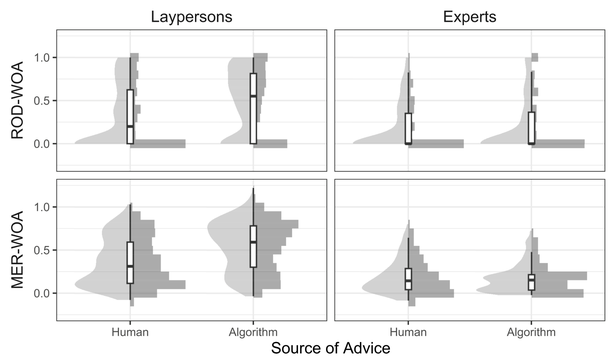
Model:

$$F_{ij} = \omega_{ij}A_{ij} + (1-\omega_{ij})I_{ij} + \varepsilon_{ij}$$
$$\omega_{ij} = \beta_0 + \alpha_i^S + \alpha_j^T + \beta_{Fam}Fam_i + \beta_{Exp}Exp_i + \beta_{Src}Src_i + \beta_{Exp\times Src}Exp_iSrc_i$$

- where: Fam_i - familiarity; Exp_i - expertise; Src_i - source

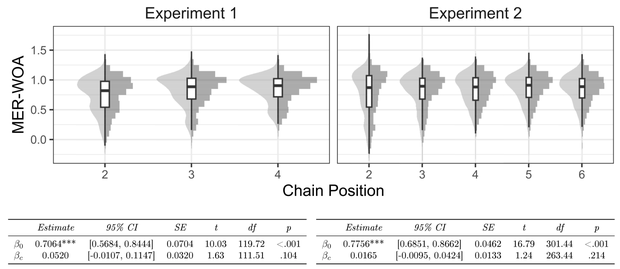
Results:

- Experts weight advice significantly less than laypersons
- Laypersons weight algorithmic more than human advice, whereas experts do not discriminate between the two
- Strict algorithm aversion or egocentrism, respectively, only in experts but not in laypersons



	Estimate	*95% CI*	*SE*	*t*	*df*	*p*
β_0	0.3240***	[0.2452, 0.4027]	0.0402	8.07	5.80	<.001
β_{Fam}	-0.0608***	[-0.0935, -0.0281]	0.0167	-3.65	345.58	<.001
β_{Exp}	-0.2536***	[-0.3391, -0.1680]	0.0436	-5.82	351.21	<.001
β_{Src}	0.0820	[-0.0029, 0.1668]	0.0433	1.90	348.86	.058
$\beta_{Exp\times Src}$	-0.2330**	[-0.4035, -0.0625]	0.0869	-2.68	348.50	.007

Sequential Collaboration



	Estimate	*95% CI*	*SE*	*t*	*df*	*p*
β_0	0.7064***	[0.5684, 0.8444]	0.0704	10.03	119.72	<.001
β_c	0.0520	[-0.0107, 0.1147]	0.0320	1.63	111.51	.104

	Estimate	*95% CI*	*SE*	*t*	*df*	*p*
β_0	0.7756***	[0.6851, 0.8662]	0.0462	16.79	301.44	<.001
β_c	0.0165	[-0.0095, 0.0424]	0.0133	1.24	263.44	.214

Paradigm: Generating final judgments by sequentially collaborating with other participants (Mayer and Heck, 2022)

Model:

$$F_{ij} = \omega_{ij}A_{ij} + \varepsilon_{ij}$$
$$\omega_{ij} = \beta_0 + \alpha_i^S + \alpha_j^T + \beta_c(c_i - 1)$$

- where: c_i - chain position

Results:

- No changes in informational influences along the chains
- Advice quality evaluation with own judgment as benchmark

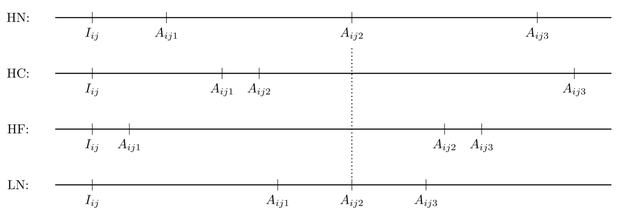
Multiple Advice Taking

Paradigm: Receiving three systematically distributed pieces of advice at once per task (Molleman et al., 2020)

Model:

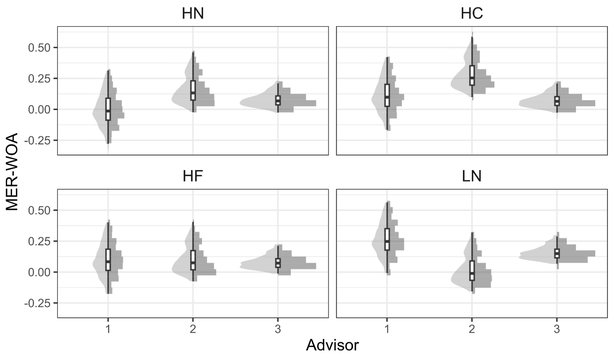
$$F_{ij} = \sum_{k=1}^{3}\omega_{ijk}A_{ijk} + \left(1-\sum_{k=1}^{3}\omega_{ijk}\right)I_{ij} + \varepsilon_{ij}$$
$$\omega_{ijk} = \beta_{k,0} + \alpha_{ik}^S + \alpha_{jk}^T + \beta_{k,HC}HC_{ij} + \beta_{k,HF}HF_{ij} + \beta_{k,LN}LN_{ij}$$

- where:



Results:

- No evidence for differential weighting of individual advice
- Inverse-U-shaped distance-weighting relationship (e.g., Schultze et al., 2015) explains descriptive treatment effects



	Estimate	*95% CI*	*SE*	*t*	*df*	*p*
$\beta_{1,0}$	0.1201*	[0.0130, 0.2273]	0.0546	2.20	615.23	.028
$\beta_{2,0}$	0.1420*	[0.0273, 0.2566]	0.0584	2.43	1111.05	.015
$\beta_{3,0}$	0.0954*	[0.0125, 0.1784]	0.0423	2.26	528.66	.024
$\beta_{1,HC}$	0.1118	[-0.1543, 0.3779]	0.1357	0.82	891.38	.410
$\beta_{2,HC}$	0.1215	[-0.1395, 0.3825]	0.1331	0.91	1209.38	.362
$\beta_{3,HC}$	-0.0055	[-0.0754, 0.0644]	0.0356	-0.15	28.19	.877
$\beta_{1,HF}$	0.0980	[-0.1403, 0.3363]	0.1215	0.81	386.09	.420
$\beta_{2,HF}$	-0.0564	[-0.3864, 0.2737]	0.1683	-0.34	600.90	.738
$\beta_{3,HF}$	0.0024	[-0.2800, 0.2848]	0.1440	0.02	442.20	.987
$\beta_{1,LN}$	0.2621*	[0.0394, 0.4849]	0.1136	2.31	667.22	.021
$\beta_{2,LN}$	-0.1415	[-0.3458, 0.0629]	0.1042	-1.36	832.45	.175
$\beta_{3,LN}$	0.0790	[-0.0802, 0.2382]	0.0812	0.97	504.58	.331

References:

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