

Actively open-minded thinking and reflection-impulsivity as alternatives to the sequential two-system theory of the cognitive reflection test and moral judgment

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Overview

- ▶ Starting point: weak correlations between CRT and utilitarian moral judgment.
- ▶ Evaluate sequential 2-system theory of CRT.
- ▶ Examine expanded versions of CRT: Belief-bias (logic) items, and items with no lures.
- ▶ Test three hypotheses about predictive power of CRT: sequential 2-system; reflection-impulsivity (R-I); actively open-minded thinking (AOT). Criteria: utilitarian moral reasoning and AOT scale.
- ▶ Determinants of utilitarian judgment: sequential 2-system, R-I, AOT, utilitarian beliefs.

Some CRT items (obd3)

- F1. A bat and a ball cost \$1.10 in total. The bat costs a dollar more than the ball. How much does the ball cost?
- F2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
- F3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? (Frederick, 2005)

- N2. If it takes 2 nurses 2 minutes to measure the blood pressure of 2 patients, how long would it take 200 nurses to measure the blood pressure of 200 patients?
- N1. Soup and salad cost \$5.50 in total. The soup costs a dollar more than the salad. How much does the salad cost?
- N3. Sally is making sun tea. Every hour, the concentration of the tea doubles. If it takes 6 hours for the tea to be ready, how long would it take for the tea to reach half of the final concentration? (Finucane & Gullion, 2010).

Some extended CRT items.

B1. All flowers have petals.

Roses have petals.

If these two statements are true, can we conclude from them that roses are flowers.

B2. All mammals walk.

Whales are mammals.

If these two statements are true, can we conclude from them that whales walk.

B3. All things that have a motor need oil.

Automobiles need oil.

If these two statements are true, can we conclude from them that automobiles have a motor.

A number (act/omission) dilemma

A guided missile was accidentally fired and is heading for a jet plane with 500 passengers. The only way to prevent this is for the air-traffic controller to instruct a smaller plane with 100 passengers to fly into the path of the missile (without telling the pilot why) and take the hit. Should the controller direct the smaller plane into to path?

yes no

What is the largest number of passenger deaths in the smaller plane that should be tolerated in order to prevent 500 passenger deaths in the larger plane?

500 400 300 200 100 0

This should not be tolerated no matter what harm is prevented by allowing it.

A rule dilemma with two acts

X is asked to testify for the prosecution at an insider trading trial. X knows that the defendant is innocent. But other witnesses have provided damaging testimony in which they distorted the truth. X also knows that, if he says what he knows, then the defendant will be wrongly convicted, because X's testimony will be mis-interpreted as consistent with the distorted testimony of others. If X says he knows nothing, despite swearing to tell "the whole truth", then the defendant will be acquitted, and nobody will find out that X lied about knowing nothing. What should X do?

Lie, saying that he knows nothing, in which case the court will correctly acquit the defendant.

Tell what he knows, as he swore under oath that he would do, in which case the defendant will be wrongly convicted.

Utilitarianism scale (obd3)

When a moral rule leads to outcomes that are worse than those from breaking the rule, we should **follow** the rule.

Always *Sometimes but not always* *Never*

When a moral rule leads to outcomes that are worse than those from breaking the rule, we should **break** the rule.

When two options harm other people in the same ways, we should choose the option that harms fewer people.

When we can help some people a lot by harming other people a little, we should do this.

When we can help some people a lot by harming other people a little, we should **not** harm the second group of people.

When one option has better effects on some people and worse effects on nobody than any other option, than this option should be chosen.

When one option has better effects on some people and worse effects on nobody than any other option, this option is not always the one that should be chosen.

Agree *Mostly agree* *Mostly disagree* *Disagree*

For decision making that affects other people, all that matters is doing good and preventing harm.

It is worse to intentionally cause some harm through action than to cause the same harm intentionally by doing nothing to prevent it (through some easy action).

Sometimes we should follow rules that require us to do things that are harmful on the whole.

Sometimes we should follow rules that prevent us from doing what is best on the whole.

Some things should not be done even if they lead to very good outcomes.

Correlations (obd3) (α in diagonals, selected Ss)

	CRT	CRT time	U-scale	U-rules	U-number
CRT	0.86				
CRT time	0.28	0.93			
U-scale	0.21	0.26	0.67		
U-rules	0.23	0.26	0.35	0.53	
U-number	0.05	0.03	0.21	0.20	0.77
R/I			0.29	0.30	0.05

One-tailed p : .26 is $p = .01$, .22 is $p = .025$.19 is $p = .05$.

Correlations of item types (obd3) (selected Ss)

	Crt-number	Crt-belief	Number times	Belief times
U-rules	0.24	0.19	0.23	0.21
U-number	0.09	-0.03	-0.07	0.17
U-scale	0.10	0.27	0.19	0.36

One-tailed p : .26 is $p = .01$, .22 is $p = .025$, .19 is $p = .05$.

Conclusions of obd3

- ▶ Failed to replicate CRT correlation with number items.
- ▶ But did find correlation with U-rules items (but that fails too, later).
- ▶ CRT measures also correlate with endorsement of utilitarian principles stated abstractly.
- ▶ The correlation is found both for time and accuracy, and these can be combined into the R-I measure.
- ▶ And it is found for belief and number CRT items.

CRT types (obd4)

- ▶ **Original arithmetic items (N1–N3 & F1–F3)**
- ▶ **Arithmetic no-lure (A1–A6)** Sally is making sun tea. Every hour, the concentration of the tea triples. If it takes 6 hours for the tea to be ready, how long would it take for the tea to reach $1/9$ of the final concentration?
- ▶ **Belief consistent (Bc1–Bc4)**, All aunts are sisters.
Some women are aunts.
If these two statements are true, can we conclude from them that some women are sisters?
- ▶ **Belief neutral (Bn1–Bn4)** All laloobays are rich.
Sandy is a laloobay.
If these two statements are true, can we conclude from them that Sandy is rich?
- ▶ **Belief inconsistent (Bi1–Bi4 & B1–B5)** All bears are ferocious.
Some stuffed animals are bears.
If these two statements are true, can we conclude from them that some stuffed animals are ferocious?

Revised U-scale

- ▶ When a moral rule leads to outcomes that are worse than those from breaking the rule, we should **follow** the rule.
- ▶ When a moral rule leads to outcomes that are worse than those from breaking the rule, we should **break** the rule.
- ▶ When two options harm other people in the same ways, we should choose the option that harms fewer people.
- ▶ When one option has better effects on some people and worse effects on nobody than any other option, then we should choose this option.
- ▶ For decision making that affects other people, all that matters is doing good and preventing harm.
- ▶ Sometimes we should follow rules that require us to do things that are harmful on the whole.
- ▶ Sometimes we should follow rules that prevent us from doing what is best on the whole.
- ▶ Some things should not be done even if they lead to very good outcomes.

Correlations (obd4) (α in diagonals)

	Lure score	No-lure score	Lure time	No-lure time	U-scale	U-rules
Lure score	0.89					
No-lure score	0.78	0.89				
Lure time	0.12	0.17	0.92			
No-lure time	0.26	0.40	0.79	0.91		
U-scale	0.04	0.02	0.25	0.22	0.72	
U-rules	0.19	0.11	0.10	0.15	0.44	0.61

.30 is $p = .001$ (1 tail), .23 is $p = .01$, .19 is $p = .025$, .16 is $p = .05$.

Correlations (tetrachoric), lure and no-lure (obd4)

		Math with lures						Math with no lures					
		N2	N1	N3	F1	F2	F3	A1	A2	A3	A4	A5	A6
Logic with lures	B1	0.35	0.6	0.67	0.52	0.34	0.62	0.74	0.44	0.66	0.45	0.48	0.75
	B2	0.27	0.46	0.64	0.44	0.3	0.44	0.66	0.19	0.58	0.39	0.46	0.56
	B3	0.44	0.59	0.65	0.52	0.46	0.57	0.68	0.46	0.61	0.43	0.5	0.69
	B4	0.42	0.5	0.61	0.38	0.45	0.51	0.61	0.43	0.65	0.44	0.31	0.74
	B5	0.18	0.46	0.62	0.43	0.27	0.43	0.58	0.15	0.46	0.38	0.41	0.46
	Bi1	0.26	0.59	0.71	0.53	0.26	0.55	0.73	0.31	0.61	0.39	0.53	0.58
	Bi2	0.36	0.51	0.59	0.51	0.3	0.6	0.62	0.43	0.61	0.48	0.34	0.66
	Bi3	0.18	0.33	0.64	0.3	0.25	0.62	0.48	0.16	0.61	0.22	0.35	0.6
	Bi4	0.2	0.24	0.52	-0.03	0.23	0.46	0.44	0.26	0.48	0.29	0.44	0.53
	Logic with no lures	Bn1	0.39	0.48	0.53	0.5	0.48	0.42	0.53	0.32	0.5	0.31	0.41
Bn2		0.12	0.59	0.53	0.43	0.17	0.41	0.49	0.38	0.34	0.45	0.52	0.45
Bn3		0.25	0.38	0.42	0.5	0.21	0.44	0.42	0.17	0.37	0.19	0.31	0.29
Bn4		0.07	0.18	0.32	0.07	-0.02	0.23	0.38	0.18	0.37	0.29	0.24	0.53

Correlations (log RT), lure and no-lure (obd4)

		Math with lures						Math with no lures					
		N2	N1	N3	F1	F2	F3	A1	A2	A3	A4	A5	A6
Logic with lures	B1	0.48	0.38	0.37	0.49	0.44	0.4	0.26	0.36	0.33	0.2	0.27	0.3
	B2	0.49	0.55	0.52	0.6	0.39	0.49	0.31	0.35	0.45	0.4	0.32	0.4
	B3	0.39	0.46	0.4	0.47	0.39	0.29	0.33	0.38	0.4	0.2	0.36	0.4
	B4	0.34	0.37	0.31	0.35	0.34	0.45	0.23	0.36	0.37	0.23	0.24	0.3
	B5	0.59	0.48	0.55	0.57	0.37	0.56	0.27	0.37	0.44	0.44	0.26	0.4
	Bi1	0.37	0.46	0.43	0.57	0.39	0.35	0.46	0.46	0.35	0.39	0.3	0.35
	Bi2	0.24	0.39	0.18	0.39	0.33	0.33	0.46	0.45	0.46	0.31	0.36	0.44
	Bi3	0.15	0.36	0.08	0.27	0.34	0.15	0.22	0.34	0.33	0.29	0.32	0.28
	Bi4	0.28	0.37	0.2	0.42	0.32	0.22	0.33	0.45	0.49	0.43	0.45	0.45
	Logic with no lures	Bn1	0.4	0.51	0.34	0.41	0.25	0.4	0.2	0.28	0.35	0.27	0.05
Bn2		0.38	0.44	0.33	0.4	0.36	0.41	0.36	0.53	0.44	0.49	0.33	0.42
Bn3		0.24	0.3	0.11	0.26	0.29	0.18	0.34	0.4	0.36	0.4	0.41	0.39
Bn4		0.3	0.41	0.23	0.39	0.36	0.26	0.29	0.49	0.45	0.44	0.4	0.46

Conclusions of obd4

- ▶ Response times (RT) correlate positively with CRT.
- ▶ Items without lures behave like other items. (But consistent belief-bias items are useful only to keep Ss honest.)
- ▶ RTs correlate with utilitarian beliefs.
- ▶ Lures do not matter for this correlation.
- ▶ Utilitarian beliefs correlate with utilitarian responses to rule dilemmas.
- ▶ But correlation of CRT score with beliefs, or with dilemmas, does not replicate.

CRT, AOT, religion (divine command theory) and utilitarian judgment (obd5)

- ▶ Act/omission number scenarios.
- ▶ Short CRT scale ($\alpha = .78$; times ($\alpha = .91$): Bi1, Bn1, Bc1, N2, N1, N3, Bi2, Bn2, A1, A2, Bn3, Bi3
- ▶ Expanded utilitarian belief scale (Uscale) ($\alpha = .60$)
- ▶ Religion (divine-command) items from Piazza and Landy (2013) ($\alpha = .83$)
- ▶ AOT scale with one added item ($\alpha = .67$)

Religion scale (Relig): “Morality questions” ($\alpha = .83$)

Response scale: Agree . . . Disagree (4 points)

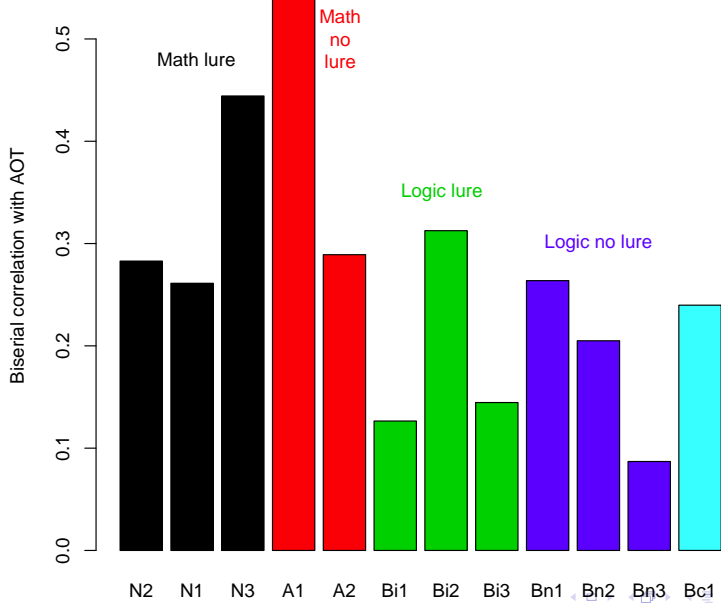
- ▶ The truth about morality is revealed only by God.
- ▶ It is possible to live a righteous life without knowledge of Gods laws. (-)
- ▶ Acts that are immoral are immoral because God forbids them.
- ▶ We dont need to try to figure out what is right and wrong, the answers have already been given to us by God.
- ▶ An atheist can still understand what is morally right and wrong. (-)
- ▶ Without God, humans still have a way to distinguish right from wrong. (-)

AOT scale: “Questions about thinking” ($\alpha = .67$)

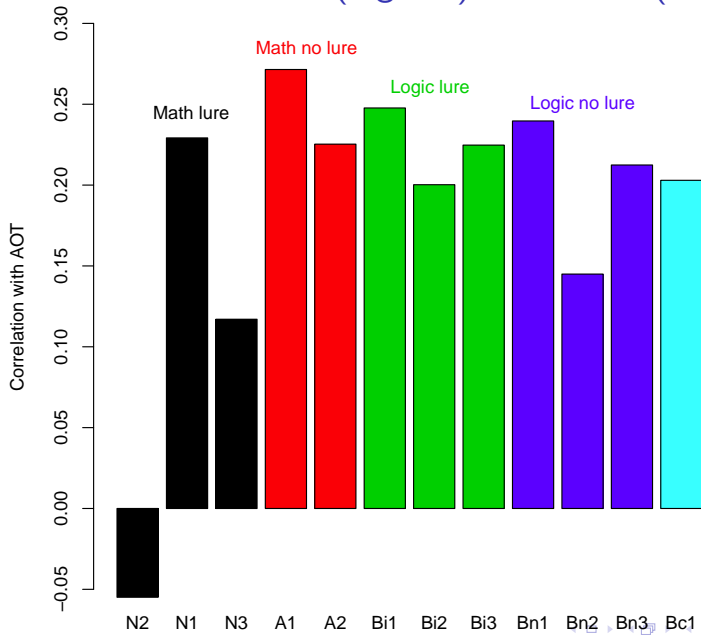
Response scale: Strongly agree ... Strongly disagree (5 points)

- ▶ Allowing oneself to be convinced by an opposing argument is a sign of good character.
- ▶ People should take into consideration evidence that goes against their beliefs.
- ▶ People should revise their beliefs in response to new information or evidence.
- ▶ Changing your mind is a sign of weakness. (-)
- ▶ Intuition is the best guide in making decisions. (-)
- ▶ It is important to persevere in your beliefs even when evidence is brought to bear against them. (-)
- ▶ One should disregard evidence that conflicts with one's established beliefs. (-)
- ▶ People should search actively for reasons why their beliefs might be wrong.

Item correlations (biserial) with AOT (obd5)



Item RT correlations (log RT) with AOT (obd5)



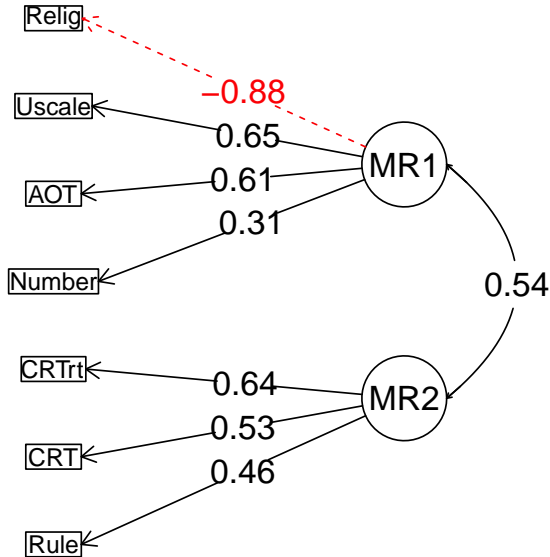
Correlations, disattenuated correlations on top (obd5)

	Relig	AOT	CRT	CRT _{rt}	U _{scale}	ActRule	ActOmit
Relig	0.83	-0.817	-0.392	-0.272	-0.808	-0.264	-0.346
AOT	-0.609	0.67	0.530	0.339	0.683	0.417	0.285
CRT	-0.315	0.383	0.78	0.469	0.577	0.323	0.212
CRT _{rt}	-0.237	0.265	0.395	0.91	0.250	0.389	0.104
U _{scale}	-0.570	0.433	0.395	0.185	0.60	0.318	0.611
ActRule	-0.200	0.284	0.237	0.308	0.205	0.69	0.436
ActNum	-0.270	0.200	0.160	0.085	0.404	0.310	0.73

Reliabilities in bold.

One-tailed p 's for raw r : $r = .237$ is $p = .01$, $r = .200$ is $p = .025$,
 $r = .169$ is $p = .05$.

Oblimin factor analysis, 2 factors



Overall conclusions

- ▶ Utilitarian responses to dilemmas seem to relate to general moral beliefs that are explicitly endorsed.
- ▶ Utilitarian beliefs, religion (divine command), and AOT are all closely related.
- ▶ Utilitarian beliefs (and sometimes choices) seem related to reflection-impulsivity.
- ▶ The CRT is also related to AOT and religion.
- ▶ The predictive power of the CRT seems more related to R/I than to sequential use of two systems.