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Mobilizing Momentum in the Science and Practice of Behavioural Insights



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A meta-analytic cognitive framework of nudge and sludge

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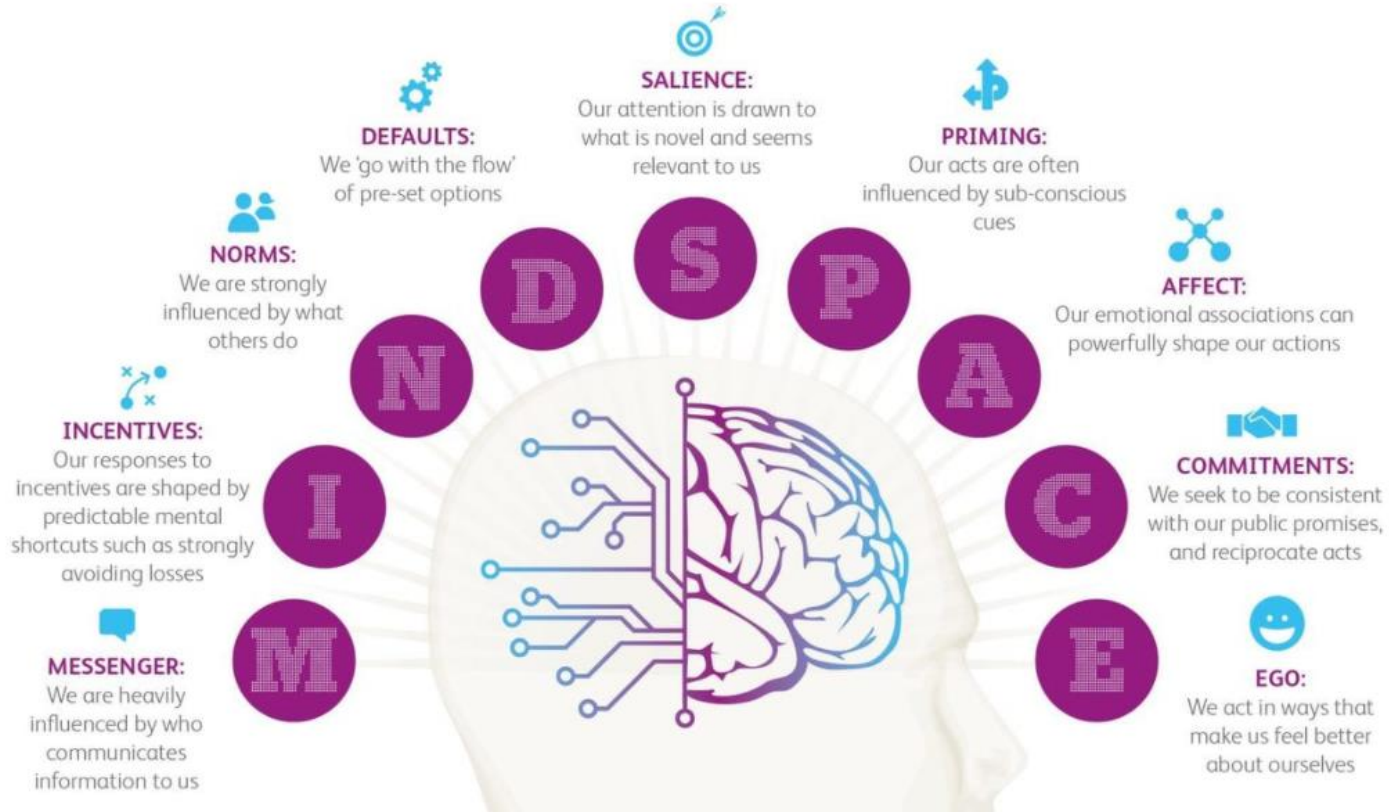


Definition of nudge and sludge

Nudge: an intervention that facilitates actions by minimizing decision friction

Sludge: an intervention that deters actions by increasing decision friction

Past frameworks



Past frameworks

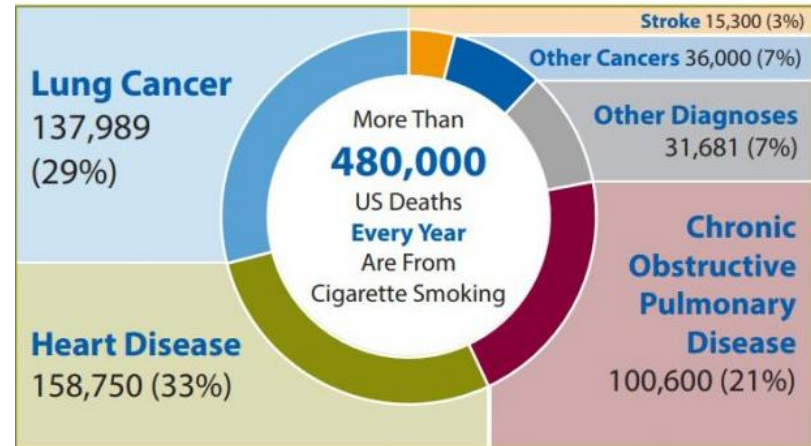
System 1

Fast, automatic, and intuitive



System 2

Slow, calculative, and deliberative



Past frameworks

EAST framework



SHIFT framework



Past frameworks

	Facilitate Decision Making	Impede Decision Making
Helps Consumers	<i>Nudge</i> : making things easy for end users	<i>Decision Points</i> or <i>Cooling-off Periods</i> : that prompt vigilance and thoughtfulness
Harms Consumers	<i>Nudge-for-Bad</i> or <i>Dark Patterns</i> : making it easy to choose welfare – reducing options (subscription traps, default add-on purchases)	<i>Sludge</i> : making it difficult to cancel subscriptions, to return products, to change privacy settings, etc.

Limitations of past frameworks

- Focused on applications (e.g., how to deliver nudge interventions)
 - Lack of theoretical understandings on nudge and sludge
- The underlying psychological mechanisms are still unclear
 - Lack of explanations on why a given intervention worked or did not work
- Limited systematic review of the effectiveness of nudge and sludge interventions
 - Lack of comparability across interventions

Our objectives

- Classify nudge and sludge under six cognitive processes: attention, perception, memory, effort, intrinsic motivation, and extrinsic motivation
- Separate interventions under each cognitive process into beneficial nudge, harmful nudge, beneficial sludge, and harmful sludge
- Conduct a meta-analysis to examine the effect size of the nudge and sludge interventions targeting each of the cognitive processes

How is each cognitive process used in nudge and sludge interventions?

Attention	Using bottom-up features (e.g., color, size) to increase or decrease the salience of an option
Perception	Framing the content of information to influence the conscious interpretation of the information
Memory	Using encoding cues or retrieval cues to alter behaviors
Effort	Changing cognitive or physical ease associated with an option
Intrinsic motivation	Influencing one's inherent interests toward an option in the absence of external factors
Extrinsic motivation	Imposing external rewards or punishments to alter behaviors

Cognitive framework of nudge and sludge

	Beneficial for people		Harmful for people	
Cognitive Processes	Nudge (decrease friction to facilitate actions)	Sludge (increase friction to deter actions)	Nudge (decrease friction to facilitate actions)	Sludge (increase friction to deter actions)
Attention	Color	“Are you sure” alert	Sensory cues in casino	Reduced font size to hide important information
Perception	Benefit framing	Cost framing	Bundle pricing (e.g., Netflix’s movie bundles);	Price partitioning (e.g., taxes, shipping fees)
Memory	Reminder (e.g., promoting college enrollment)	Reminder (e.g., deterring from overconsumption)	Repetitive advertising	Absence of reminder at the end of the trial period
Effort	Auto-enrollment plan	Inconvenience	Easy access to unhealthy food	Complex cancellation procedures
Intrinsic motivation	Social norm (e.g., promoting donation)	Social norm (e.g., deterring overconsumption)	Junk food advertising	Vaping norm exposure
Extrinsic motivation	Small financial incentives	Small fees for no-shows	Micro-incentives to gamble	Membership fees

Past meta-analyses on nudge

Study	Domain	Methodology	Type of interventions	Largest effect size
Cadario & Chandon, 2020	Heathy eating	Field	Single and mixed	Behaviorally-oriented (e.g., ease to access healthy options)
Beshears & Kosowsky, 2020	Across domains	Field, lab, online, and survey	Single and mixed	Nudges that use automaticity
Hummel & Maedche, 2019	Across domains	Field, lab, online, and survey	Single	Defaults

Limitations of past meta-analyses on nudge

- Focused on a single domain (e.g., healthy eating)
 - Limited generalizability across domains
- Combining different nudges in one condition (e.g., kitchen sink)
 - Unable to distinguish the effect of each nudge
- Mixture of self-reported, laboratory studies, and field experiments
 - Inconsistencies in measures and contexts
- Mixture of quasi-experiments and randomized controlled trials
 - Unclear which is the causal factor

Meta-analysis

Search terms: (nudge OR nudging OR sludge OR sludging) AND field

Year: 2008-2020

Domains: education, energy, environment, finance, health, and policy making

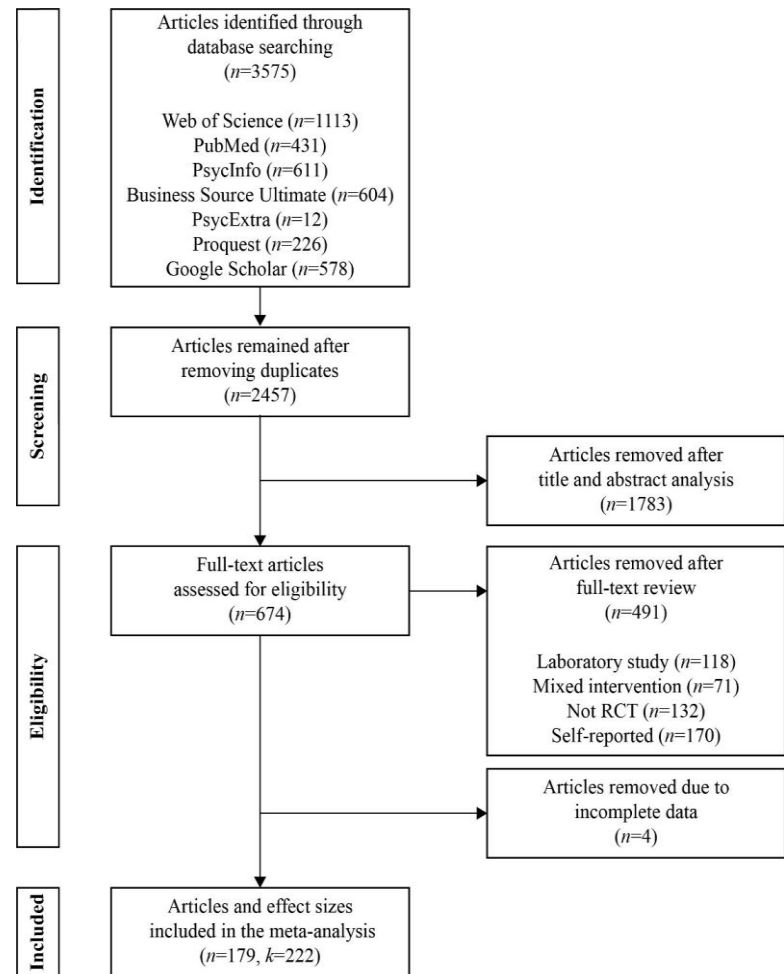
Measure: real behaviors from field experiments

Effect size coding: converted to Cohen's d

Number of articles: 179

Number of effect sizes: 222

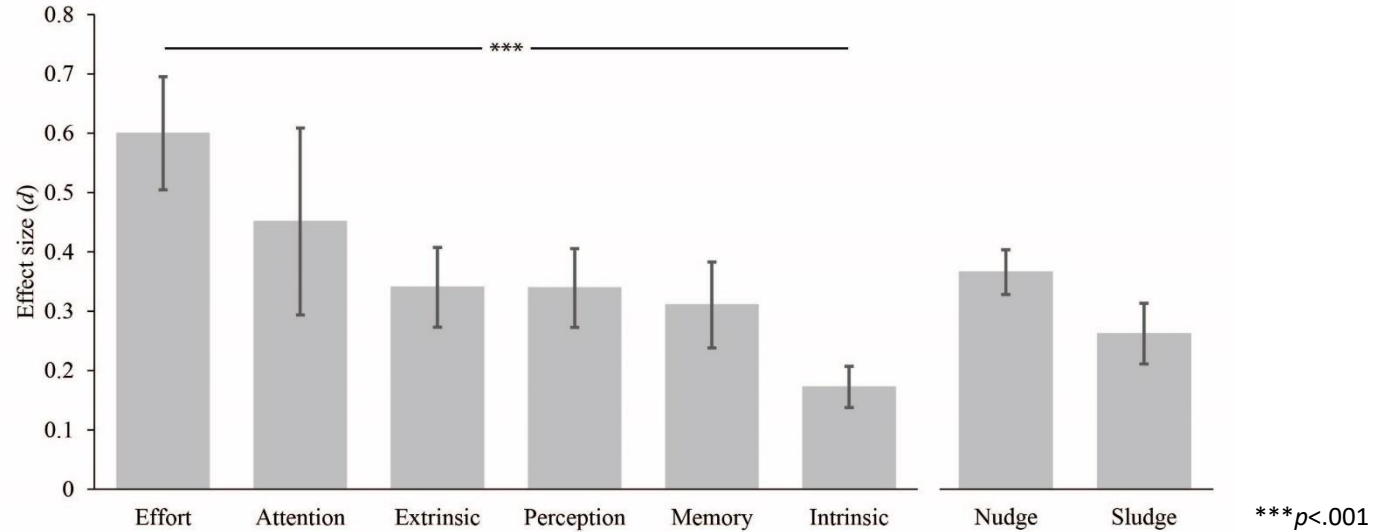
Number of participants: 4,440,011



Results

Cognitive process	Type	<i>k</i>	<i>d</i> [95% CI]	Combined <i>d</i> [95% CI]
Attention	Nudge	16	0.34 [0.05, 0.64]	0.32 [0.08,0.56]
	Sludge	4	0.14 [-0.41, 0.70]	
Perception	Nudge	39	0.31 [0.17, 0.45]	0.30 [0.18, 0.41]
	Sludge	10	0.25 [0.03, 0.47]	
Memory	Nudge	41	0.29 [0.14, 0.43]	0.29 [0.14, 0.43]
	Sludge	2	0.32 [0.24., 0.40]	
Effort	Nudge	27	0.61 [0.38, 0.85]	0.58 [0.39, 0.77]
	Sludge	8	0.44 [0.08, 0.80]	
Intrinsic motivation	Nudge	37	0.15 [0.08, 0.23]	0.13 [0.07, 0.18]
	Sludge	16	0.07 [0.01, 0.12]	
Extrinsic motivation	Nudge	18	0.32 [0.16, 0.47]	0.31 [0.17, 0.44]
	Sludge	4	0.28 [-0.22, 0.79]	
Overall	Nudge	178	0.33 [0.26, 0.39]	0.30 [0.25, 0.36]
	Sludge	44	0.20 [0.12, 0.29]	

Results



Effort-based interventions are the most effective
Followed by attention-based interventions
Nudge and sludge had the same effect size

Results

Intervention	Cognitive process	k (>5)	d [95% CI]
Default	Effort	13	0.73 [0.32, 1.13]
Highlighting	Attention	7	0.57 [-0.22, 1.36]
Accessibility	Effort	8	0.40 [0.18, 0.62]
Informational messaging	Perception	10	0.38 [0.08, 0.69]
Reminder	Memory	32	0.29 [0.13, 0.46]
Commitment making	Intrinsic	6	0.29 [-0.05, 0.63]
Gain framing	Perception	11	0.28 [-0.03, 0.58]
Financial incentives	Extrinsic	13	0.28 [0.09, 0.47]
Visibility	Attention	9	0.20 [-0.04, 0.43]
Priming	Memory	9	0.17 [-0.10, 0.44]
Social norm	Intrinsic	33	0.11 [0.04, 0.18]

Effort-decreasing interventions (e.g., default, accessibility) and Attention-grabbing interventions (e.g., highlighting) are the most effective

Discussion

- A novel meta-analytic cognitive framework of nudge and sludge
- Interventions targeting effort and attention had the largest effect size
- Interventions targeting intrinsic motivation had the smallest effect size
- Nudge interventions were equally effective as sludge interventions

Theoretical contributions

- Provided an unifying framework for nudge and sludge
- The framework organizes nudge and sludge based on six cognitive processes governing decision making

Empirical contributions

- Allowed comparisons of effect sizes across different interventions
- Allowed direct comparisons between nudge and sludge
- Offered a ranking of interventions based on effect sizes
- Consistent behavioral measures from field experiments only
- Elucidated the causal factor with randomized controlled trials only

Practical contributions

- Nudge designers should consider effort-reducing interventions first and attention-grabbing interventions second
- Intrinsic motivation interventions (e.g., social norms, implementation intention) should be considered last
- A well-designed single nudge can be highly effective without combining multiple nudges

Thank you!



Dr. Dilip Soman



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