Behaviour change techniques and their mechanisms of action

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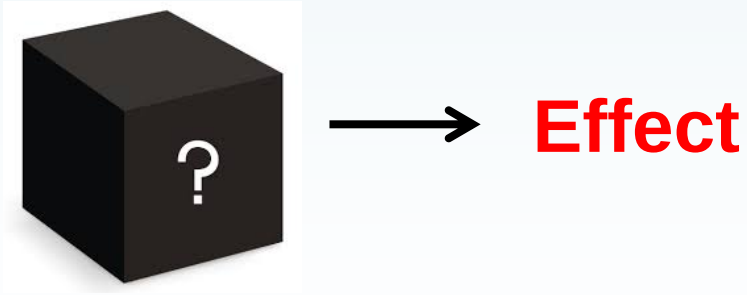
UCL Centre for Behaviour Change

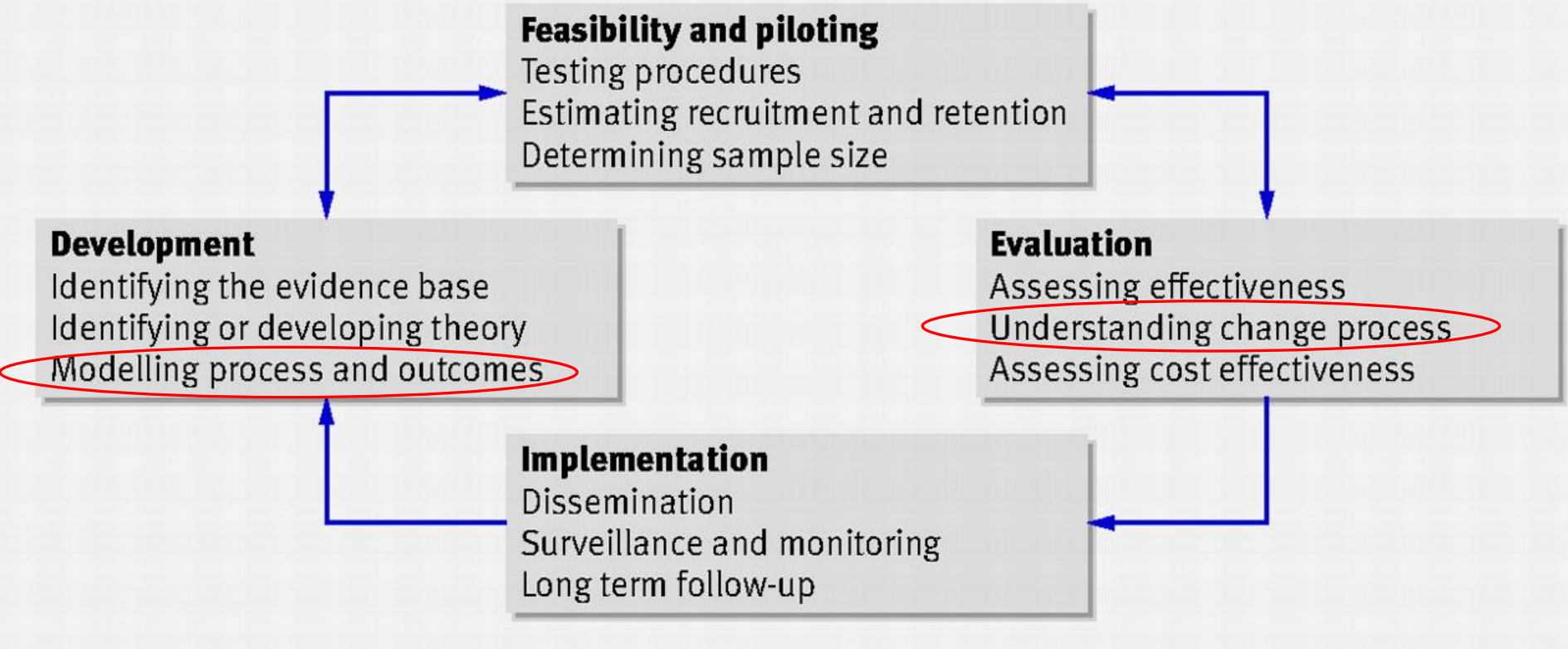
Interventions to change behaviour

- Are complex and have had variable and often modest effects
  - *E.g. Cochrane systematic reviews*
- If we are to improve interventions, need to
  - Unpack the black box of interventions
    - What is in the black box?
    - How do components have their effect?
    - How to use this information to design more effective interventions?



MRC Guidance for developing and evaluating complex interventions

Craig et al, 2009 *BMJ*



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Effect

What is in the black box?

- Poor descriptions of interventions
  - Vague and lacking detail
  - Inconsistent and varying terminology
- We need good, clear descriptions
  - Using language that is understood by all
    - Same term used for same component
- Without this, we are limited in our ability to
  - Replicate or implement effective interventions
  - Evaluate quality of delivery and mechanisms of action
  - Investigate reasons for variation
  - Improve interventions

Method for describing interventions: Behaviour change techniques (BCTs)

- "Active ingredients" within the intervention designed to change behaviour
- They are
  - discrete, low-level components of an intervention that on their own have potential to change behaviour
  - observable and replicable

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ORIGINAL ARTICLE

The Behavior Change Technique Taxonomy (v1) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of Behavior Change Interventions

Susan Michie, DPhil, CPsychol · Michelle Richardson, PhD · Marie Johnston, PhD, CPsychol · Charles Abraham, DPhil, CPsychol · Jill Francis, PhD, CPsychol · Wendy Hardeman, PhD · Martin P. Eccles, MD · James Cane, PhD · Caroline E. Wood, PhD

Abstract

Background CONSORT guideli… …gredients in an open- reporting of behavior chang… …ment amongst six researchers ous methods of cha… …ition descriptions by BCTs was tions with pr… …s This resulted in 93 BCTs clustered into 16 groups. *Objec*… Of the 26 BCTs occurring at least five times, 23 had adjusted kappas of 0.60 or above.

Conclusions "BCT taxonomy v1," an extensive taxonomy of 93 consensually agreed, distinct BCTs, offers a step change as a method for specifying interventions, but we anticipate further development and evaluation based on international, interdisciplinary consensus.

Electronic supplementary material The online version of this article (doi:10.1007/s12160-013-9486-6) contains supplementary material, which is available to authorized users.

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W. Hardeman

93 item BCT Taxonomy v1, Annals of Behavioral Medicine, 2013

BCT Taxonomy v1

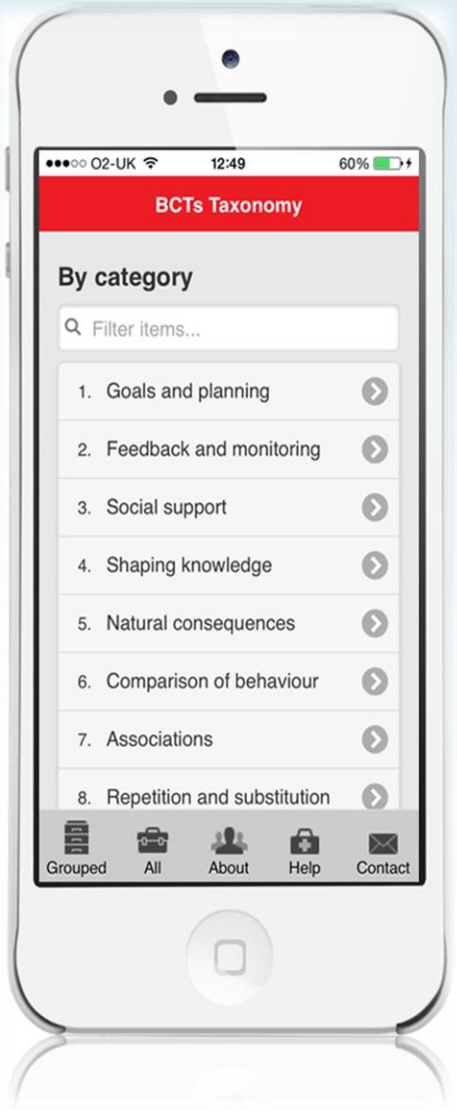
- Developed by 400 experts from 12 countries
- Clearly labelled, well defined, distinct, precise; can be used with confidence by a range of disciplines and countries
- Hierarchically organised to improve ease of use
- Applies to an extensive range of behaviour change interventions

BCT Taxonomy v1: 93 items in 16 groupings

Page	Grouping and BCTs	Page	Grouping and BCTs	Page	Grouping and BCTs
1	**1. Goals and planning**	8	**6. Comparison of behaviour**	16	**12. Antecedents**
	1.1. Goal setting (behavior) 1.2. Problem solving 1.3. Goal setting (outcome) 1.4. Action planning 1.5. Review behavior goal(s) 1.6. Discrepancy between current behavior and goal 1.7. Review outcome goal(s)		6.1. Demonstration of the behavior 6.2. Social comparison 6.3. Information about others' approval		12.1. Restructuring the physical environment 12.2. Restructuring the social environment 12.3. Avoidance/reducing exposure to cues for the behavior 12.4. Distraction 12.5. Adding objects to the
		9	**7. Associations**		
			7.1. Prompts/cues		

No.	Label	Definition	Examples
1. Goals and planning			
1.1	***Goal setting (behavior)***	Set or agree on a goal defined in terms of the behavior to be achieved *Note: only code goal-setting if there is sufficient evidence that goal set as part of intervention; if goal unspecified or a behavioral outcome, code **1.3, Goal setting (outcome)**; if the goal defines a specific context, frequency, duration or intensity for the behavior, also code **1.4, Action planning***	Agree on a daily walking goal (e.g. 3 miles) with the person and reach agreement about the goal Set the goal of eating 5 pieces of fruit per day as specified in public health guidelines

The BCT smartphone app



- Search by BCT label, BCT category or alphabetically

or

Find by search term: BCTs

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  - *E.g. Cochrane systematic reviews*
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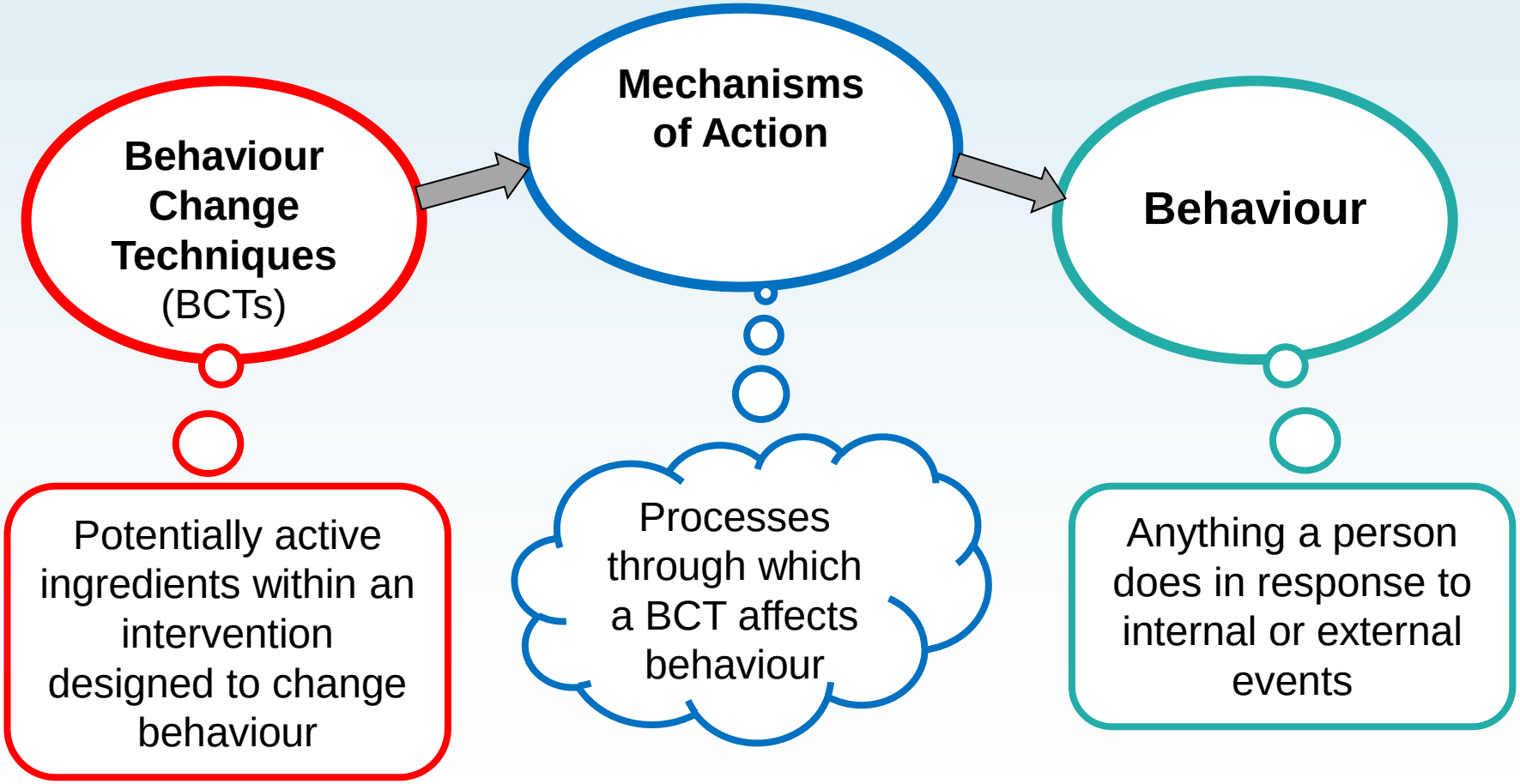
→ **Effect**

How do BCTs have their effect? (process evaluation)



Why link BCTs to their theoretical mechanisms of action?

1. For effective interventions, to understand their possible mechanisms of action

2. To design interventions based on theory

Theories and Techniques of Behaviour Change Project 2013-16







UCL

UNIVERSITY OF ABERDEEN

UNIVERSITY OF MINNESOTA

UNIVERSITY OF CAMBRIDGE

MRC Medical Research Council

Protocol Paper

ann. behav. med.
DOI 10.1007/s12160-016-9816-6

ORIGINAL ARTICLE

From Theory-Inspired to Theory-Based Interventions: A Protocol for Developing and Testing a Methodology for Linking Behaviour Change Techniques to Theoretical Mechanisms of Action

Susan Michie, PhD[1] · Rachel N. Carey, PhD[1] · Marie Johnston, PhD[2] · Alexander J. Rothman, PhD[3] · Marijn de Bruin, PhD[2] · Michael P. Kelly, PhD[4] · Lauren E. Connell, PhD[1]

Two data sources:

1. Published reports of interventions
2. Expert consensus

Findings: Literature analysis

- 974 published interventions
- 277: interventions explicitly hypothesised a link between BCT and mechanism of action
- 2639 links
  - approx. 10 links per paper (*SD* = 13.80)
- **84** significant links, covering 51 BCTs

Examples of significant links

Behaviour Change Technique		Mechanism of Action	# Papers
Feedback on Behaviour	→	Subjective Norms**	19
Self-Monitoring of Behaviour	→	Behavioural Regulation**	18
Social Support (Unspecified)	→	Social Influences**	34
Information about Health Consequences	→	Knowledge**	18
Pros and Cons	→	Attitude towards the Behaviour**	9
Behavioural Practice/Rehearsal	→	Skills**	24
Graded Tasks	→	Beliefs about Capabilities**	28

$^{**}p < .001$

Findings: Expert consensus

BCT Theory
STUDY TWO
Expert-Agreed Explicit Links

- **101** experts answered the following question:
  - When [BCT X] is effective in changing behaviour, does it do so by changing [Mechanism of Action Y]?

Definitely Yes	Possibly	Uncertain/ Don't Know	Definitely No

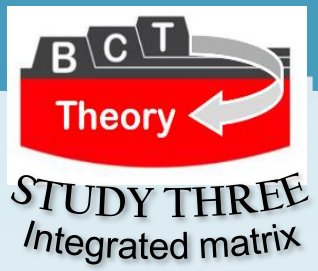
- Of 1,586 links (61 BCTs x 26 Mechanisms of Action) considered :
  - **90** links agreed: ≥80% of experts rated 'definitely yes'
  - **464** agreed not a link: ≥80% of experts 'definitely no'

Findings: 100% Agreement

BCT Theory
STUDY TWO
Expert-Agreed Explicit Links

Behaviour Change Technique		Mechanism of Action
Problem Solving	→	Behavioural Regulation
Goal Setting (Outcome)	→	Goals
Discrepancy between Current Behaviour and Goal	→	Feedback Processes
Social Comparison	→	Social Influences
Prompts & Cues	→	Behavioural Cueing
Comparative Imagining of Future Outcomes	→	Beliefs about Consequences
Social Reward	→	Reinforcement
Incentive (Outcome)	→	Motivation
Conserving Mental Resources	→	Memory, Attention and Decision Processes
Verbal Persuasion about Capability	→	Beliefs about Capabilities

Findings: Triangulating the data



- Total of **92** BCT-Mechanism of Action links identified by experts, covering **51** of 93 BCTs & **20** of 26 MoAs.

Examples of agreed links:

Type of Inconsistency from Studies 1 & 2	Example of data from Study 3	
	Link	% experts*
Evidence of link in Study 1, disagreement about link in Study 2	Self-Monitoring of Behaviour → Behavioural Regulation	94% rated 'definitely yes'
Evidence of link in Study 1 and 'definitely no' link in Study 2	Avoidance/Reducing Exposure to Cues→ Needs	100% rated 'definitely no'

** N = 16*

The Human Behaviour-Change Project, 2016-20

Participating organisations

UCL

University of Aberdeen

University of Cambridge

IBM Research

www.humanbehaviourchange.org

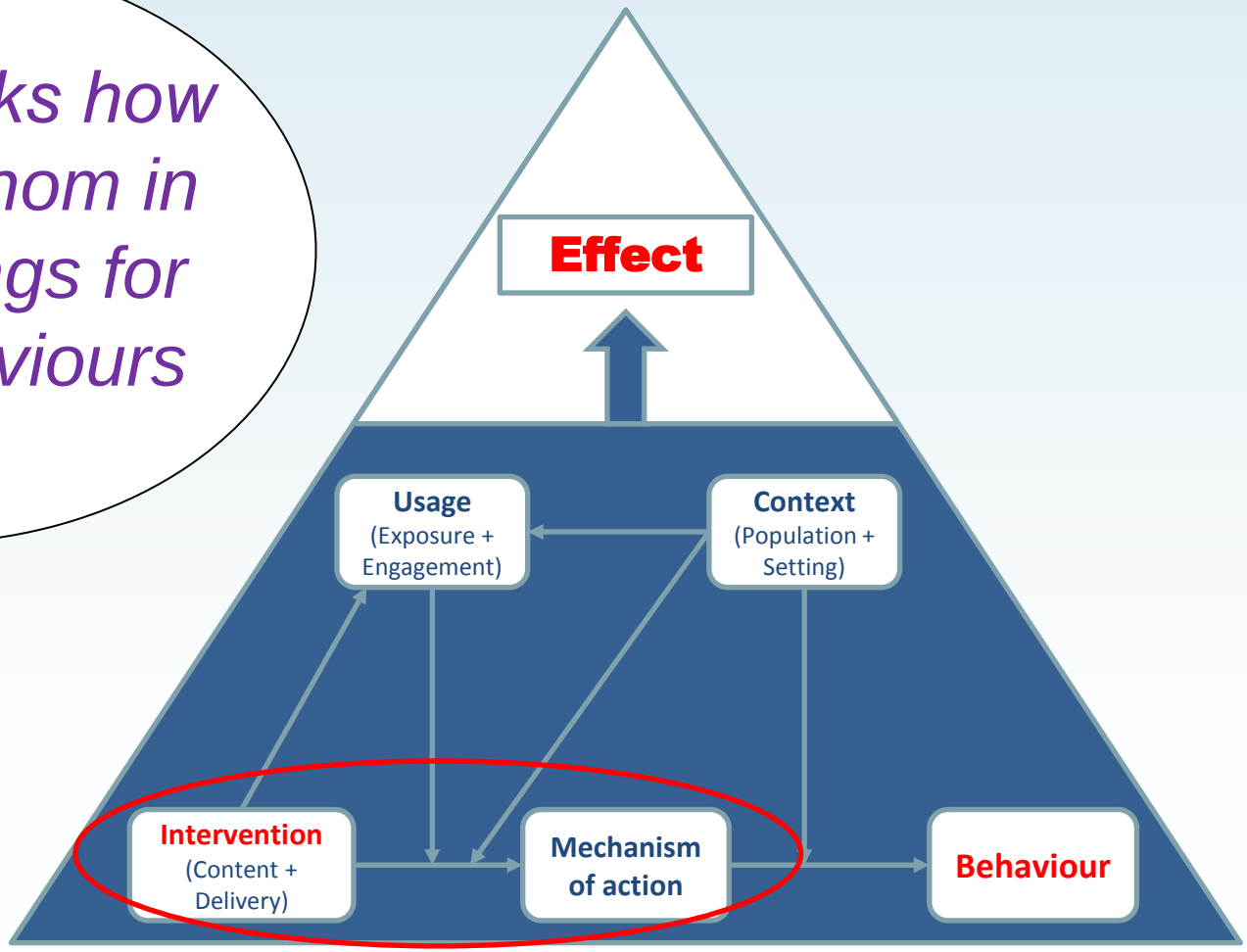
@HBCProject

A Collaborative Award funded by the wellcome trust

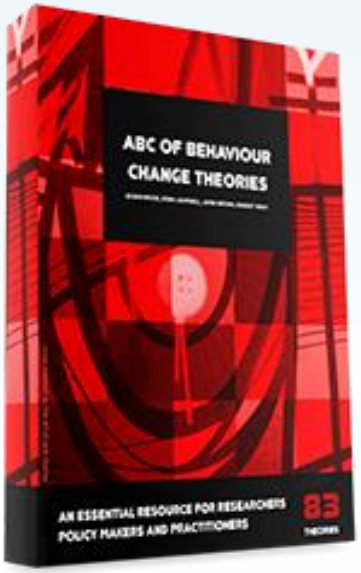
The Behaviour Change Intervention Ontology

Human Behaviour-Change Project

"What works how well, for whom in what settings for what behaviours and why?"



For more information



- UCL Centre for Behaviour Change
  - www.ucl.ac.uk/behaviour-change
- Susan Michie
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UCL Centre for Behaviour Change

All proceeds from CBC teaching, training, books and products go to further development

MSc in Behaviour Change

www.ucl.ac.uk/behavior-change

- Cross-disciplinary
- Taught by world experts
- Links to placements

Course Directors:
Prof Susan Michie & Dr Paul Chadwick

- Register now for September 2017
- Open to students from diverse backgrounds
- Full-time or part-time

Additional slides

BCTTv1 Developments

Online Training:

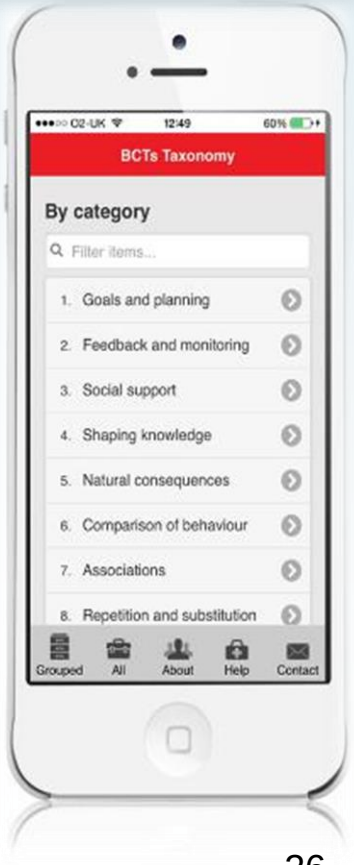
www.bct-taxonomy.com

Feedback on BCTTv1:

www.ucl.ac.uk/behaviour-change-techniques/BCTTv1Feedback

BCTTv1 App:

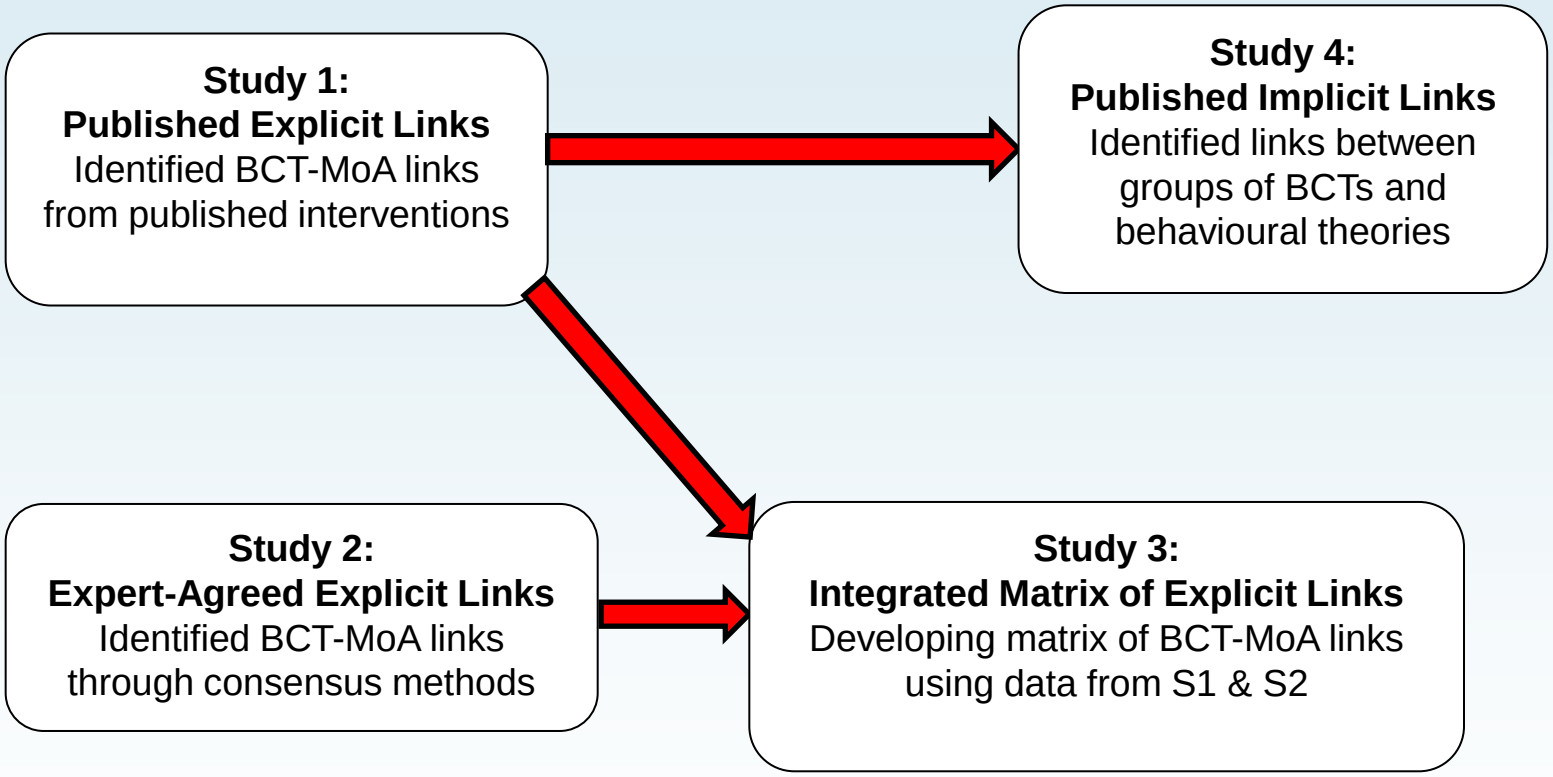
Search for ‘BCT Taxonomy’



Database of BCTTv1-coded interventions

www.bct-taxonomy.com/interventions

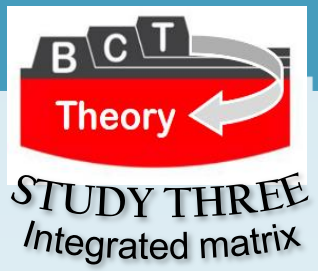
Summary of four studies



Findings: Significant links

- Series of binomial tests conducted on the data
- Expected frequency used for comparison was calculated for each individual link as:
  - Probability BCT A was coded × probability MoA B was coded.
- *p* value = index of the likelihood that observed frequency of hypothesised link occurred more often than would be expected compared to chance.
- Using this method, we identified **84** significant links, covering 51 BCTs

Findings: Triangulating the data



- BCT-MoA links from literature synthesis & expert consensus (n = 100) were compared and categorised into:

Categorisation	# links	Examples
Evidence of link in both studies	36	Information about Health Consequences → Perceived Susceptibility
No evidence of link in Study 1, evidence of 'no link' in Study 2	461	Problem Solving → Reinforcement
No evidence in Study 1, no strong evidence (either way) in Study 2	904	Goal Setting (Outcome)→ Beliefs about Consequences
Inconsistencies and marginal evidence	185	Social Reward → Motivation

- New group of experts (n=16) rated these 185 links

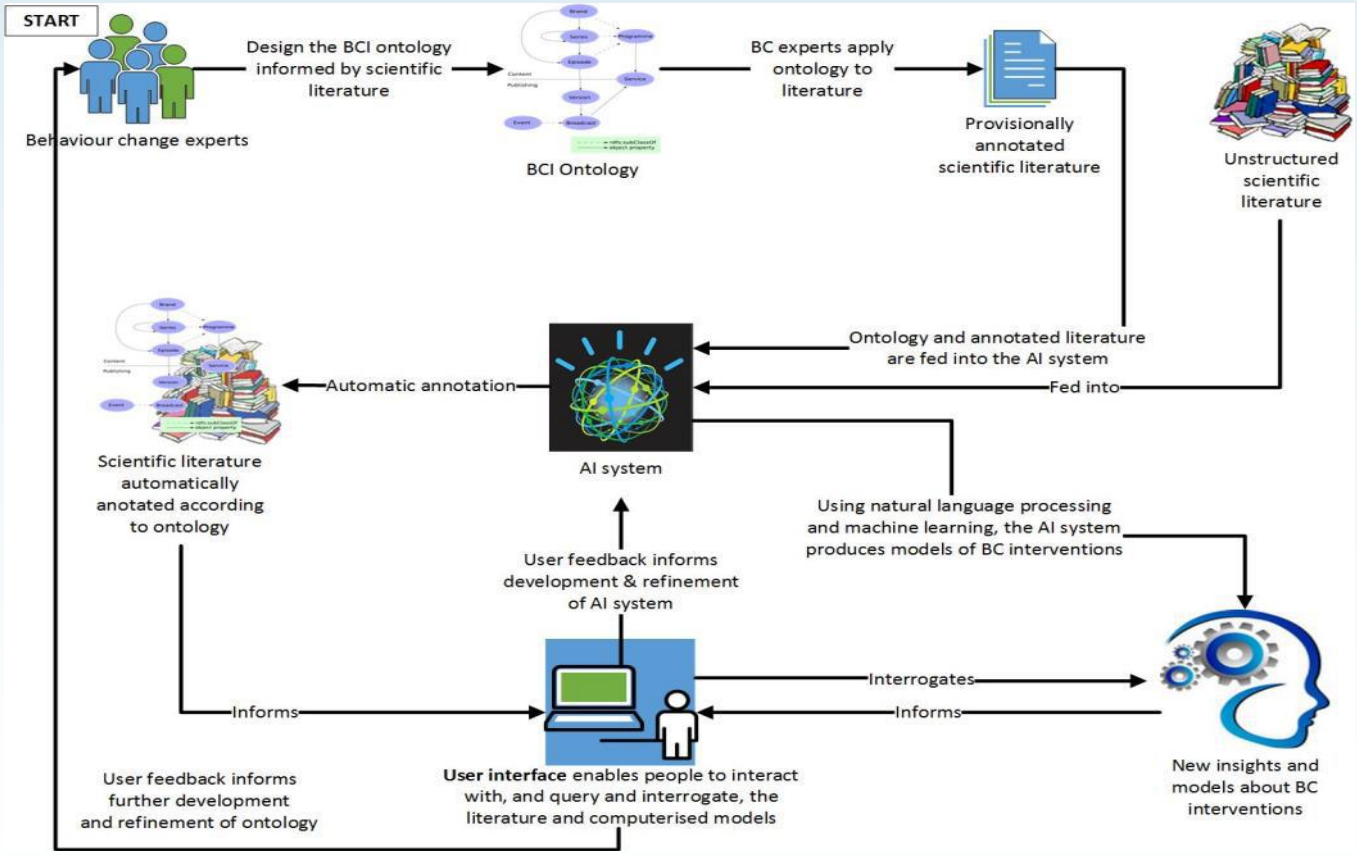
What is an ontology?

Human Behaviour-Change Project

- An ontology = systematic method for specifying concepts and the relationships between them using a “controlled vocabulary”
  - e.g. behaviour change techniques, theoretical constructs, behaviours
- An ontology of behaviour change interventions
  - Includes taxonomies of the key concepts e.g.
    - » behaviour change techniques, mechanisms of action, behaviour

The collaboration of 3 sciences

Human Behaviour-Change Project



Building the BCI Ontology: mechanisms

'Theory and Techniques' project 2014-17

Marie Johnston
University of Aberdeen

Marijn de Bruin
University of Aberdeen

Susan Michie
University College London

Alex Rothman
University of Minnesota

Mike Kelly
University of Cambridge

Rachel Carey
Research Associate, UCL

Lauren Connell
Research Assistant, UCL

- International Advisory Board

41 experts from 11 countries

1. **Systematic review: what does the literature (>300 articles) tell us?**
2. **Expert consensus: what do 98 experts from 18 countries think?**
3. **Triangulation**

Building the BCI Ontology: behaviours

- Led by Kai Larsen, University of Colorado
  - with Robert West
- 5,461 articles from 3 leading journals in
  - Psychology, Education, Behavioral Medicine, Business, Management, Marketing, Information Systems, Nursing
- 2,375 behavioural variables
  - Extending WHO's International Classification of Functioning, Disability and Health (ICF)
    - Using NIH National Cancer Institute's thesaurus

    >100,000 definitions of biomedical concepts

    https://ncit.nci.nih.gov/ncitbrowser/
    - Created 8 levels of hierarchy

Building the Ontology: modes of delivery

- Categories inductively generated from published research
- A reliable taxonomy with 4 levels
  - With Rachel Carey, Robert West, Fiona Evans (UCL) & Marie Johnston (Aberdeen)

Acknowledgments

- Funders including
- Many have contributed to my thinking and work
  - especially …Robert West and Marie Johnston
  - **UK**

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  - **US:** Alex Rothman, Blair Johnson, Kai Larsen, Bill Riley, Karina Davidson, Donna Spruitj-Metz, Eric Hekler, Frank Davidoff
  - **Canada**: Jeremy Grimshaw, Heather Gainforth
  - **Australia**: Paul Glasziou, Ron Borland, Sally Green, Denise O'Connor

Research team