



# Behaviour Change Taxonomy (Ontology)



**Susan Michie**

Centre for Behaviour Change  
University College London, UK



**@SusanMichie**



# This talk

1. What is an Ontology and where do taxonomies fit in?
2. Why do we need them for behavioural trials?
3. Where have we got to?
4. Next steps



# Current state of play

- Behavioural interventions
  - establish effectiveness
- Consideration of the wider context
- Most have had little or no measurable effects
  - e.g. reviews from cochrane, NICE

*How can we  
improve this  
situation?*



# Behavioural interventions

- Most are complex
  - Made up of many interacting components
- To design more effective interventions, need to
  - know what the components are and why they work
  - unpack the “black box” of interventions



**Effect**

- **What** is in the black box? [**content**]
- **Why** do components have their effect? [**theory**]
- **How** do they vary across contexts? [**theory**]



# Room for improvement ...

- Taken as a whole, our trial reporting and published literature is chaotic
  - Different terms for same concept
  - Same term for different concepts
  - Relationships between concepts either not or poorly specified
- Problem for science and for implementation



# Example: varying terminology in specifying intervention content

Title of journal article	Description of “behavioural counseling”
The impact of <b>behavioral counseling</b> on stage of change fat intake, physical activity, and cigarette smoking in adults at increased risk of coronary heart disease	“ <b>educating</b> patients about the benefits of lifestyle change, encouraging them, and suggesting what changes could be made” (Steptoe et al. <i>AJPH</i> 2001)

Effects of internet <b>behavioral counseling</b> on weight loss in adults at risk for Type 2 diabetes	“ <b>feedback</b> on <b>self-monitoring</b> record, <b>reinforcement</b> , recommendations for change, answers to questions, and general support” (Tate et al. <i>JAMA</i> 2003)
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# Methodological advances needed to ...

- **Accumulate** evidence efficiently
  1. **Replicate** for incremental advance
    - Explicitly build on past work rather than start anew or present as 'new'
  2. **Minimise waste** in research
    - Improve **reporting**, **fidelity** of delivery and use of **theory** ... for replication and evidence synthesis
  3. **Co-ordinate** vs fragment
    - To maximise effectiveness and efficiency of building evidence and advancing theory
    - **Ontologies** useful for this purpose



# What is an ontology?

- 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



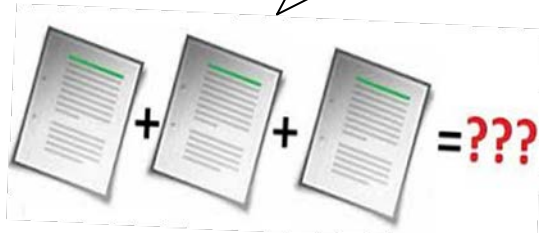


# The Behaviour Change Intervention

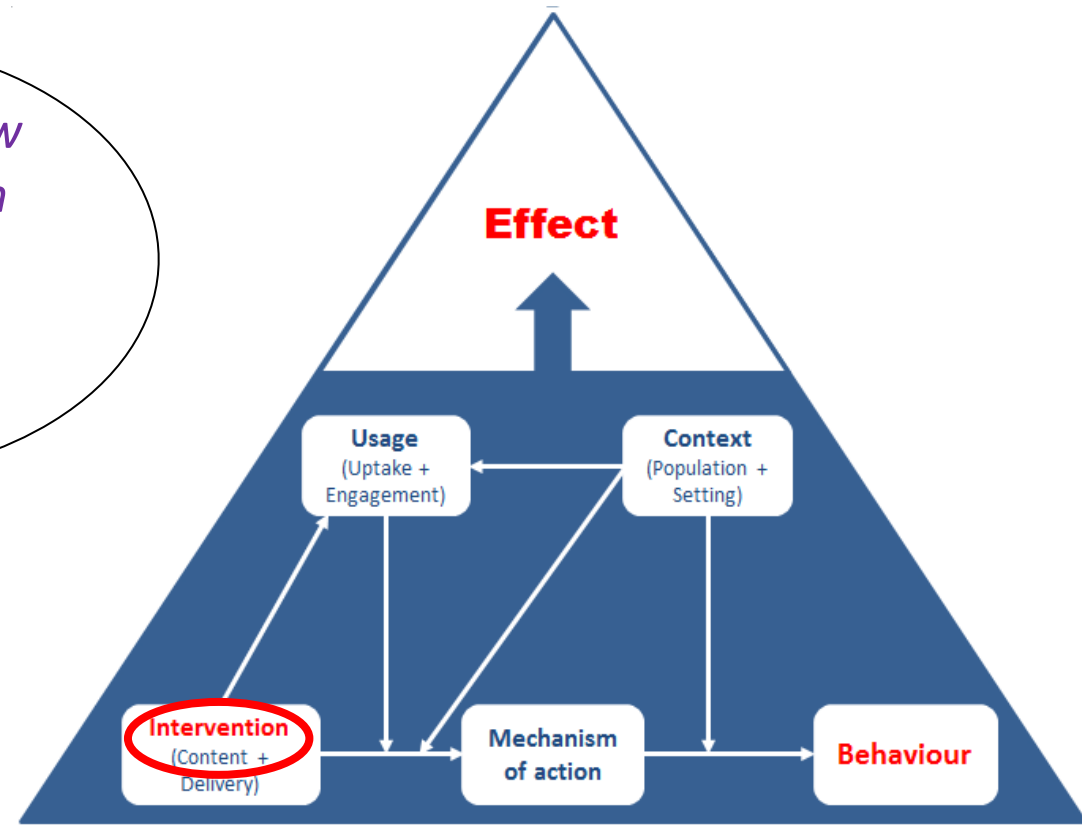
## Ontology West & Michie, 2016

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international  
behavioural  
trials network

*“What works how well, for whom in what setting for what behaviours and why?”*



Unorganised world literature



# Describing content using a shared language

- Behaviour change techniques (BCTs)
  - The smallest components that on their own have the *potential* to bring about change
  - The ‘active ingredients’ of an intervention
  - Observable and replicable
  - Can be used alone or in combination with other BCTs



# “Taxonomies” of BCTs

- Physical activity/healthy eating/mixed  
*Abraham & Michie, 2008*
- Physical activity & health  
*Michie et al, Psychology & Health*
- Smoking cessation  
*Abraham et al, Journal of Clinical Behavioral Medicine, 2010*
- Reducing alcohol consumption: 42 BCTs, *Michie et al, Addiction, 2012*
- Combining BCTs: 42 BCTs, *Abraham et al, 2012*
- Behaviour change: 137 BCTs  
*Michie et al, Applied Psychology: An International Review, 2008*
- Competence framework: 89 BCTs, *Dixon & Johnston, 2011*

Fragmentation rather than integration



# Bringing the taxonomies together, 2010-13



Michie, Johnston, Abraham, Francis, Hardeman, Eccles, Wood, Cane, Richardson

To develop a unified taxonomy using literature and expert consensus

- 400 participants from 12 countries across a range of disciplines



# Results

- 93 clearly labelled, well **defined** **precise** BCTs
- **Hierarchically** **groupings** to improve

Full programme of work, 5 studies,  
Michie et al, (2015) Health Technology Assessment, 19 (99)  
et al, BJHP, 2014

## 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



Article Metrics

199

Citations

63

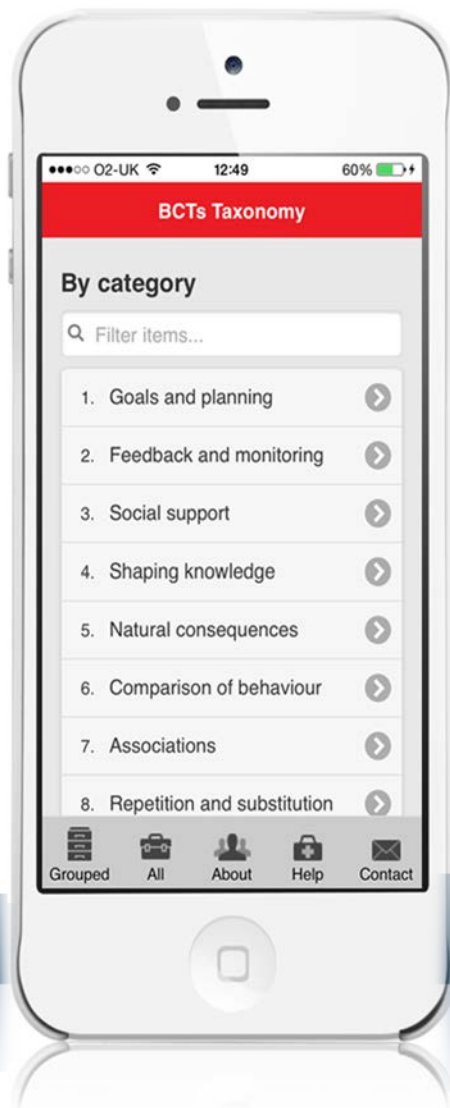
Social

# BCT Taxonomy v1: 93 items in 16 groupings

Page	Grouping and BCTs	Page	Grouping and BCTs	Page	Grouping and BCTs
<b>1</b>	<b>1. Goals and planning</b>	<b>8</b>	<b>6. Comparison of behaviour</b>	<b>16</b>	<b>12. Antecedents</b>
	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
		<b>9</b>	<b>7. Associations</b>		
			7.1. Prompts/cues		

No.	Label	Definition	Examples
<b>1. Goals and planning</b>			
<b>1.1</b>	<b><i>Goal setting (behavior)</i></b>	Set or agree on a goal defined in terms of the behavior to be achieved <i>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 <b>1.3, Goal setting (outcome)</b>; if the goal defines a specific context, frequency, duration or intensity for the behavior, <u>also</u> code <b>1.4, Action planning</b></i>	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

# BCTTv1 smartphone app




- Search by BCT label, BCT grouping or alphabetically



or



Find by search term: BCTs



new / untrained  
users

## Welcome

The Behaviour Change Technique Taxonomy – a resource for intervention designers, researchers, practitioners, systematic reviews and all those wishing to communicate the content of behaviour change interventions.

[Login](#)[New User?](#)[forgot?](#)

Trained users

“Tasks and session materials made a great combination”

*Tutorial trainee, Cambridge UK*





# BCT methodology provides an agreed, standard method to ...

- **Describe** interventions as accurately as possible
  - **Replicate** interventions to generate evidence
  - Assess **fidelity**
  - **Implement** effective interventions
- **Evaluate** e.g. in reviews or factorial designs
  - Identify **active ingredients** (what)
  - Investigate **mechanisms of action** (how)
- **Design** interventions
  - BCTs linked to broader intervention frameworks



# Feedback and plans for developing BCTTv2

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Please [click here for the BCTTv1 online feedback form](#).

<http://www.ucl.ac.uk/behaviour-change-techniques/BCTTv1Feedback>

BCTTv1 was developed with the understanding that, in a few years, feedback from international users would lead to the development of BCTTv2.

In order to inform this development, we encourage users of BCTTv1 to submit information about their experiences within this portal. We would be grateful for any feedback and suggestions you have, including:

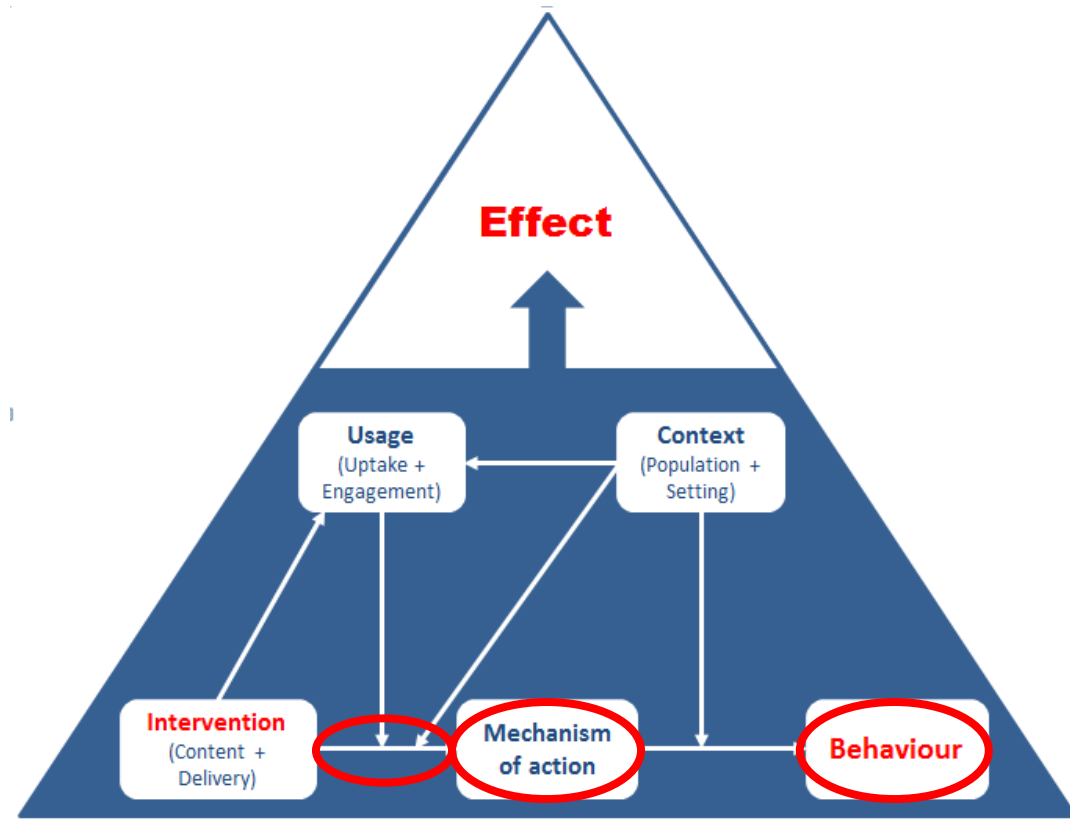
- Additional BCTs not in BCTTv1
- Amendments to labels or definitions of specific BCTs
- BCTs found to be difficult to use
- Adaptations or translations of BCTTv1
- Reliability data
- General suggestions for improvement

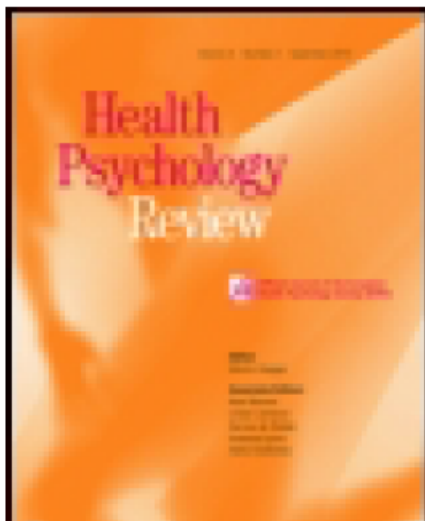
With many thanks for your contribution. All those submitting information considered by the future reviewing consortium will be acknowledged. We anticipate data will be formally reviewed in 2017.

Best wishes,

The BCTTv1 Team.

# Building the Behaviour Change Intervention Ontology





## **Health Psychology Review**

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/rhpr20>

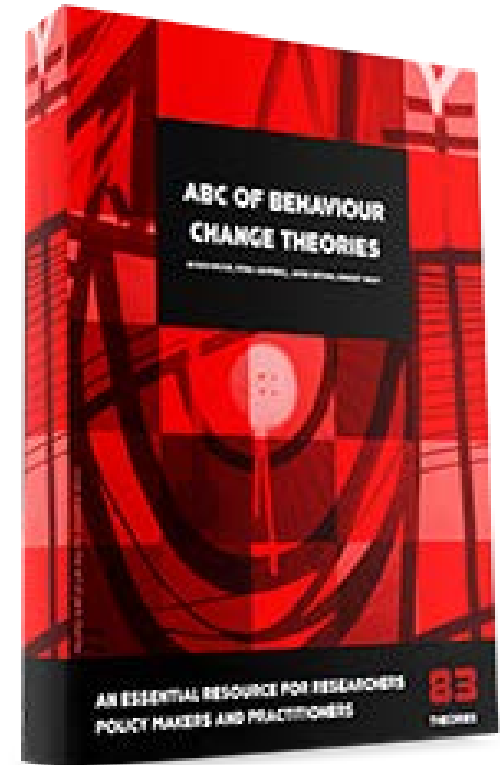
### **Theories of behaviour and behaviour change across the social and behavioural sciences: a scoping review**

Rachel Davis<sup>a</sup>, Rona Campbell<sup>b</sup>, Zoe Hildon<sup>a</sup>, Lorna Hobbs<sup>a</sup> & Susan Michie<sup>a</sup>

Cross-disciplinary literature review with Advisory group from psychology, sociology, anthropology and economics

# Results

- 83 theories
  - Summary of original description
  - List of constructs
    - **1725**; mean **21**, range **5-84**
  - Integrating theoretical constructs ('mechanisms') into a taxonomy
  - Future: Searchable website



Michie et al, [www.behaviourchangetheories.com](http://www.behaviourchangetheories.com), 2014

# Mechanisms

## Identifying hypothesised links between BCTs and mechanisms, 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

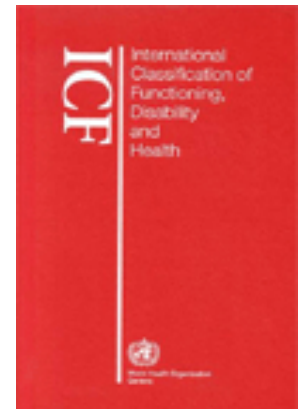
- International Advisory Board  
42 experts from 11 countries

1. **Systematic review: what does the literature (280 articles) tell us?**
2. **Expert consensus: what do >100 experts from 18 countries think?**
3. **Triangulation**

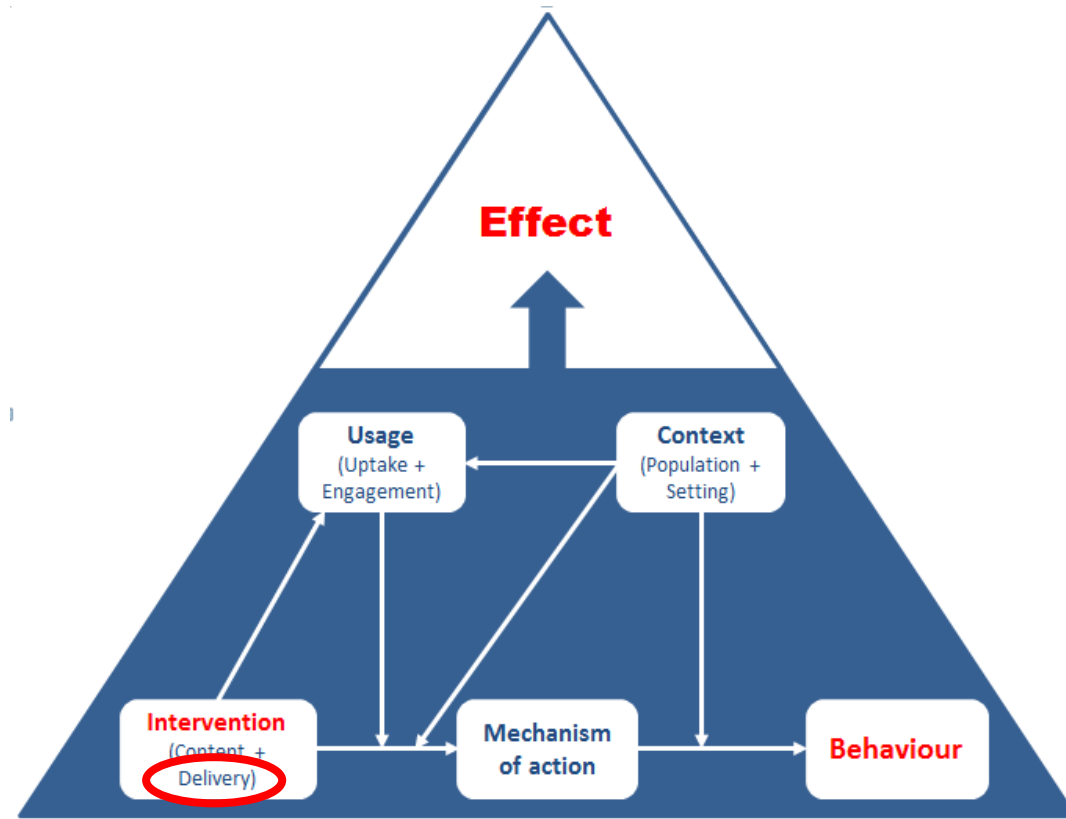
# Building the BCI Ontology: Behaviours



- Led by Kai Larsen, University of Colorado
  - with Robert West, University College London
- 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)
  - We have created 6 levels of hierarchy



# The Behaviour Change Intervention Ontology





# Building the BCI 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)





Human Behaviour-  
Change Project

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# The Human Behaviour-Change Project, 2016-2020:

Building the science of behaviour change for  
complex intervention development



**wellcome**trust



# The Collaboration

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- **Behavioural Science**



Susan Michie (PI)



Marie Johnston



Robert West



Mike Kelly

- **Information Science**



James Thomas

- **Computer Science**



John Shaw-Taylor



Pol Mac Aonghusa

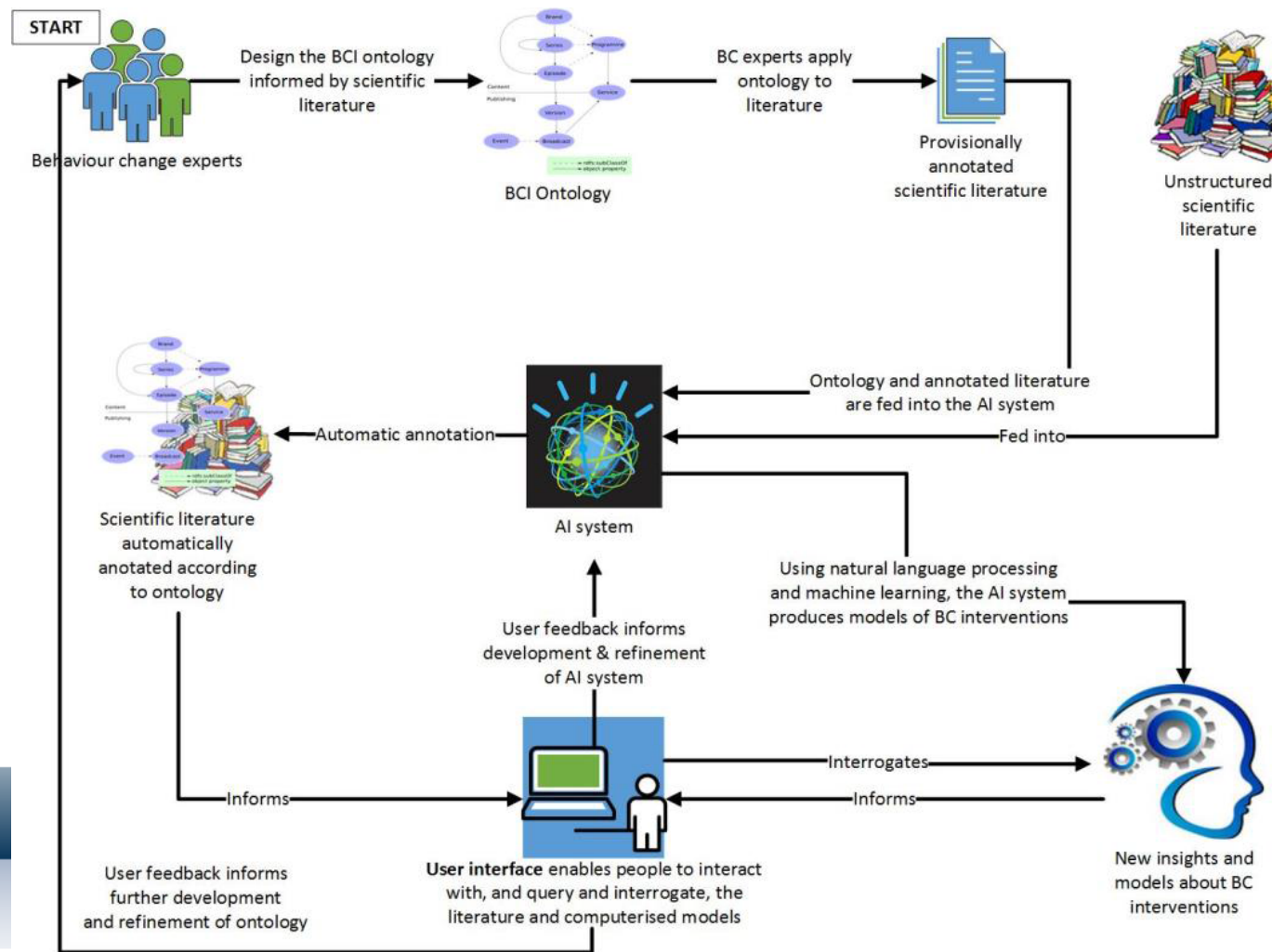


# The Project

- To address the key question in behavioural science:
  - *What works*
    - *how well, for whom, in what setting*
    - *for what behaviours and why?*
- We require
  1. an '**Ontology**' of behaviour change interventions
  2. A **computational model**, using Artificial Intelligence, to organise the evidence
    - extract information from the vast and rapidly accelerating world scientific literature, using Natural Language Processing, organised into this Ontology
    - generate new behavioural insights by synthesising this evidence
  3. A **user interface** to allow scientists and policy-makers to draw on evidence in real-time to address the key question



# The process of collaboration of three sciences



# Evaluating the Ontology and AI System

- Pilot the ability of the system to maintain updated syntheses of the literature in 4 case studies:
  - Smoking, alcohol consumption, diet, physical activity
    - Start with smoking which has the most extensive & definitive evidence base
- Evaluation criteria include:
  - The adequacy of the new system in **comparison with traditional** evidence synthesis to provide information that is ..
    - more **accurate, extensive, useable** and **timely**
  - The **utility** of the system as assessed by users



# Conclusion

- The aim of this programme of research is to:
  1. Efficiently and rapidly make progress in advancing our **understanding of behaviour change**
  2. Harness and develop the powers of **AI for effectively** synthesising research evidence
  3. Make **accessible the world literature** on behavioural interventions in real-time
- For the benefit of:
  1. All scientists
  2. Policy-makers and intervention designers



# Thanks to ....

**ibtn**  
international  
behavioural  
trials network

- Funders

**wellcome**trust



**NHS**  
*National Institute for  
Health Research*



- The many who have contributed to my thinking and work
  - especially ...Robert West and Marie Johnston



- My research team





# CBC Summer School 2016

## Behaviour Change – Principles and Practice

8<sup>th</sup> – 12<sup>th</sup> August 2016

University College London

### Course format

- Monday to Friday, 9.30 – 17.00
- Highly participatory, with short presentations, discussions and small group work
- End-of-day mentoring sessions to work on own project, guided by an expert
- Lunch and refreshments provided
- Networking reception on the first and penultimate evenings



Additional week  
added due to high  
demand!

Registration  
opening soon!



**UCL Centre for Behaviour Change**

[www.ucl.ac.uk/behaviour-change](http://www.ucl.ac.uk/behaviour-change)



@UCLBehaveChange

# NEW: MSc in Behaviour Change

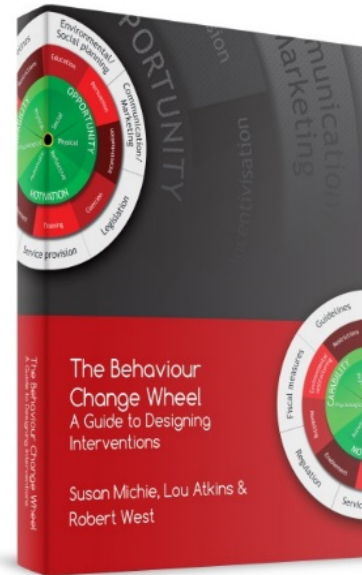
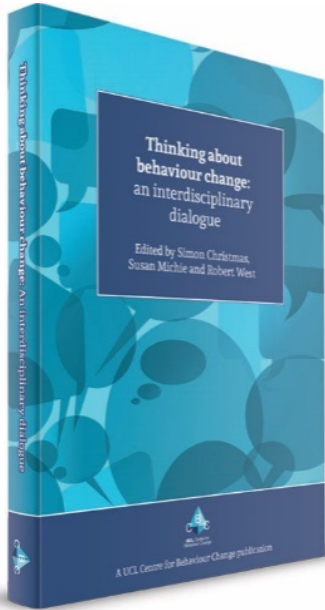
Taught by world leaders across many disciplines and with close links to practical placements across many sectors.

- Launching September 2017
- Transdisciplinary approach
- Open to students from diverse backgrounds
- Full-time or part-time



# For more information

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- UCL Centre for Behaviour Change
  - [www.ucl.ac.uk/behaviour-change](http://www.ucl.ac.uk/behaviour-change)
- Susan Michie, [s.michie@ucl.ac.uk](mailto:s.michie@ucl.ac.uk)



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