Revolutionising evidence synthesis and use: the Human Behaviour-Change Project

Human Behaviour-Change Project

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Rosenthal Symposium, 2019

UCL Centre for Behaviour Change

The Human Behaviour-Change Project

Human Behaviour-Change Project

Participating organisations

UCL

University of Aberdeen

University of Cambridge

IBM Research

www.humanbehaviourchange.org

@HBCProject

A Collaborative Award funded by the

wellcome trust

[1]UCL [2]IBM Research Dublin
[3]Aberdeen University
[4]Cambridge University

The collaboration

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	Behavioural science	Computer science	System architecture
Grant-holders	Susan Michie[1] Marie Johnston[3] Robert West[1] Mike Kelly[4]	John Shawe-Taylor[1] Pol MacAonghusa[2]	James Thomas[1]
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Vision of the project

To develop an understanding of human behaviour
to answer variants of the 'big question'

When it comes to behaviour change interventions:

What works,
compared with what,
for what behaviours,
how well, for how long,
with whom, in what setting,
and why?

How the project came about

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1. Experience on NICE's Public Health Interventions Advisory Committee & working with Government policy-makers
   - Evidence synthesis process not fit for purpose
     - Too slow, partial evidence, integrated poorly
2. Frustration with slow advance of behavioural science
   - Interventions poorly reported
     - Different terms for the same things
   - Poorly specified & overlapping theories
     - Slow accumulation of knowledge

NICE National Institute for Health and Care Excellence

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Challenges	Solutions
Research conduct: Diversity of research methods and topics; inconsistency and incompleteness in reporting	Ontology of behaviour change interventions

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Challenges	Solutions
Research conduct: Diversity of research methods and topics; inconsistency and incompleteness in reporting	Ontology of behaviour change interventions
Resource limitations: Insufficient human resources given the increasing volume of research	Use of automated literature searching and study feature extraction
Research findings: Equivocal or contradictory findings; sparseness of findings relative to the variety of behaviours, interventions, contexts; complexity of interactions between intervention components, contexts and behaviours	Use of machine learning and reasoning algorithms for evidence synthesis and interpretation

The problem

"Messy" evidence, growing faster than humans can keep up with

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The problem

"Messy" evidence, growing faster than humans can keep up with

Messy evidence gets turned into well organised, useful scientific insights

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- Up to date estimates of the effectiveness of behaviour change interventions
- Unpacking reasons for heterogeneity in intervention effectiveness
- Generating new testable hypotheses about behaviour change

The problem

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What the HBCP does

Artificial Intelligence
Natural Language Processing
Machine Learning

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HBCP
Human Behaviour-Change Project

The problem

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What the HBCP does

Ontology provides organising structure to guide

Artificial Intelligence
Natural Language Processing
Machine Learning

Messy evidence gets turned into well organised, useful scientific insights

- Up to date estimates of the effectiveness of behaviour change interventions
- Unpacking reasons for heterogeneity in intervention effectiveness
- Generating new testable hypotheses about behaviour change

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Upper-level
Behaviour Change Intervention Ontology

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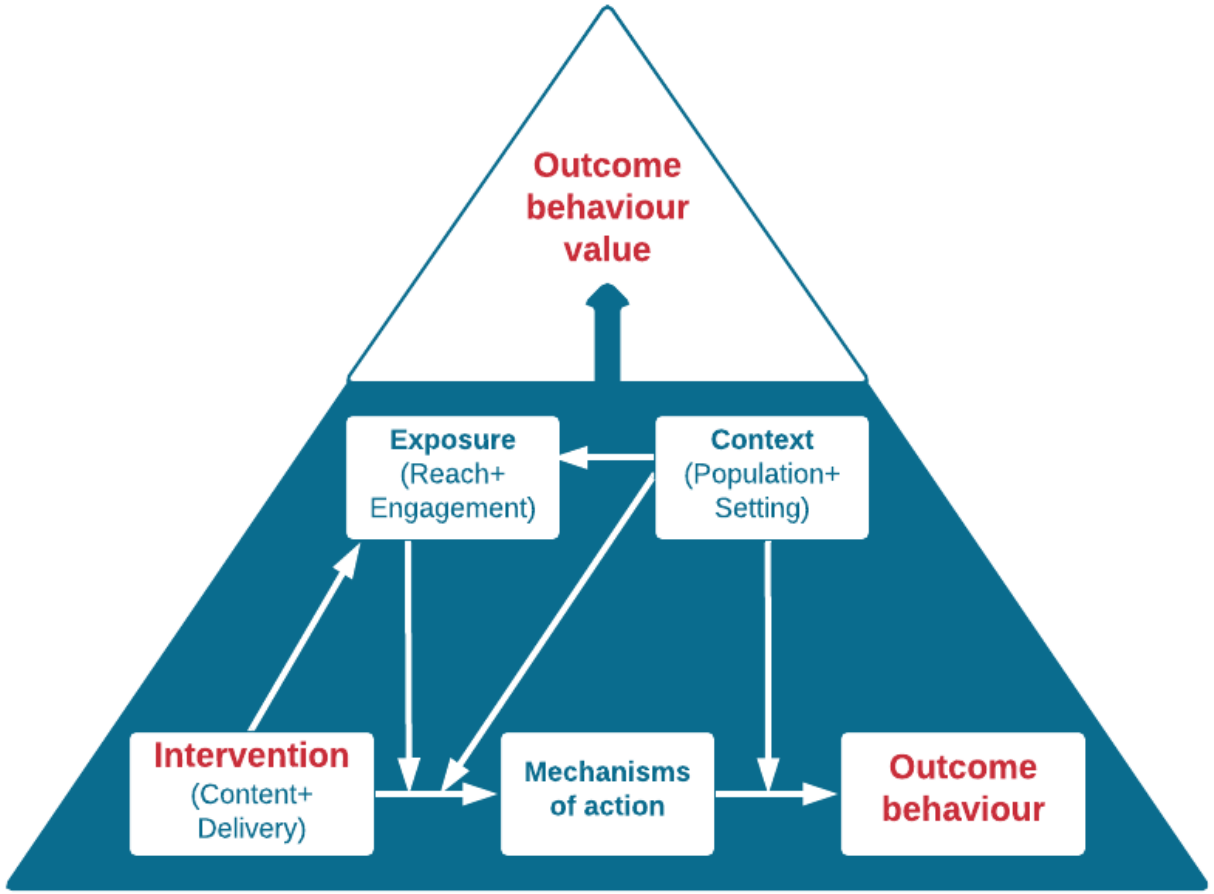

Upper level entities in BCIO

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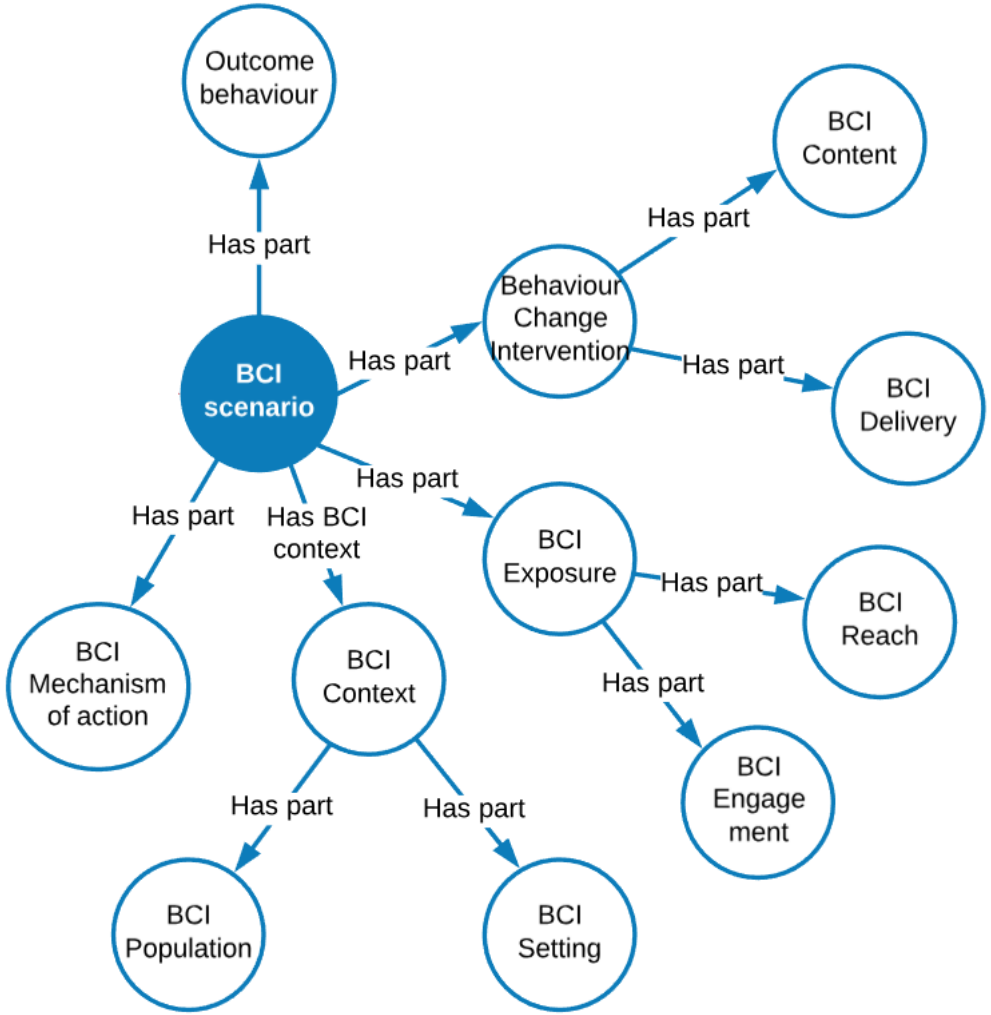

The BCI scenario

Upper level entities in BCIO

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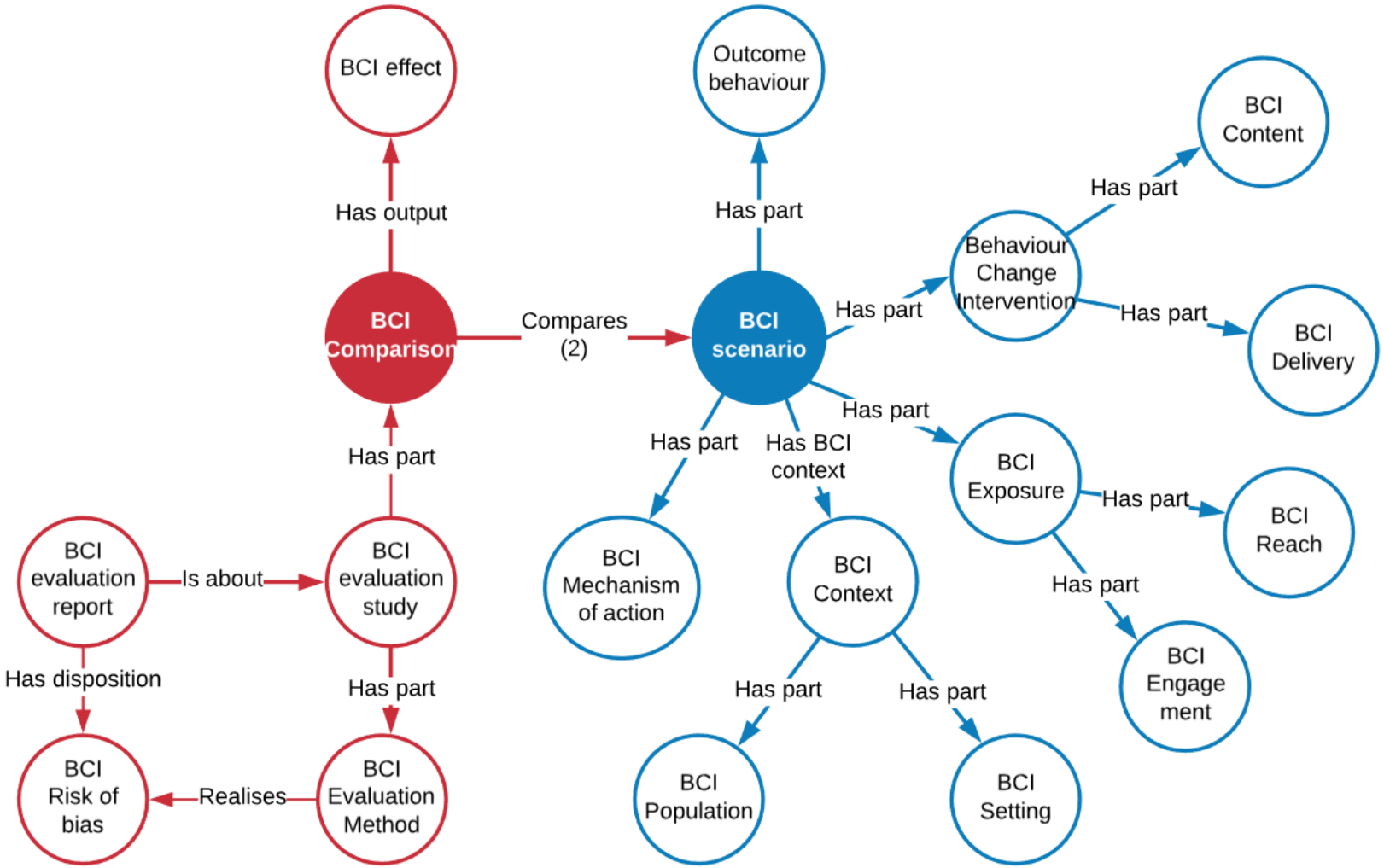
The BCI comparison



The BCI scenario

The Behaviour Change Intervention Knowledge System

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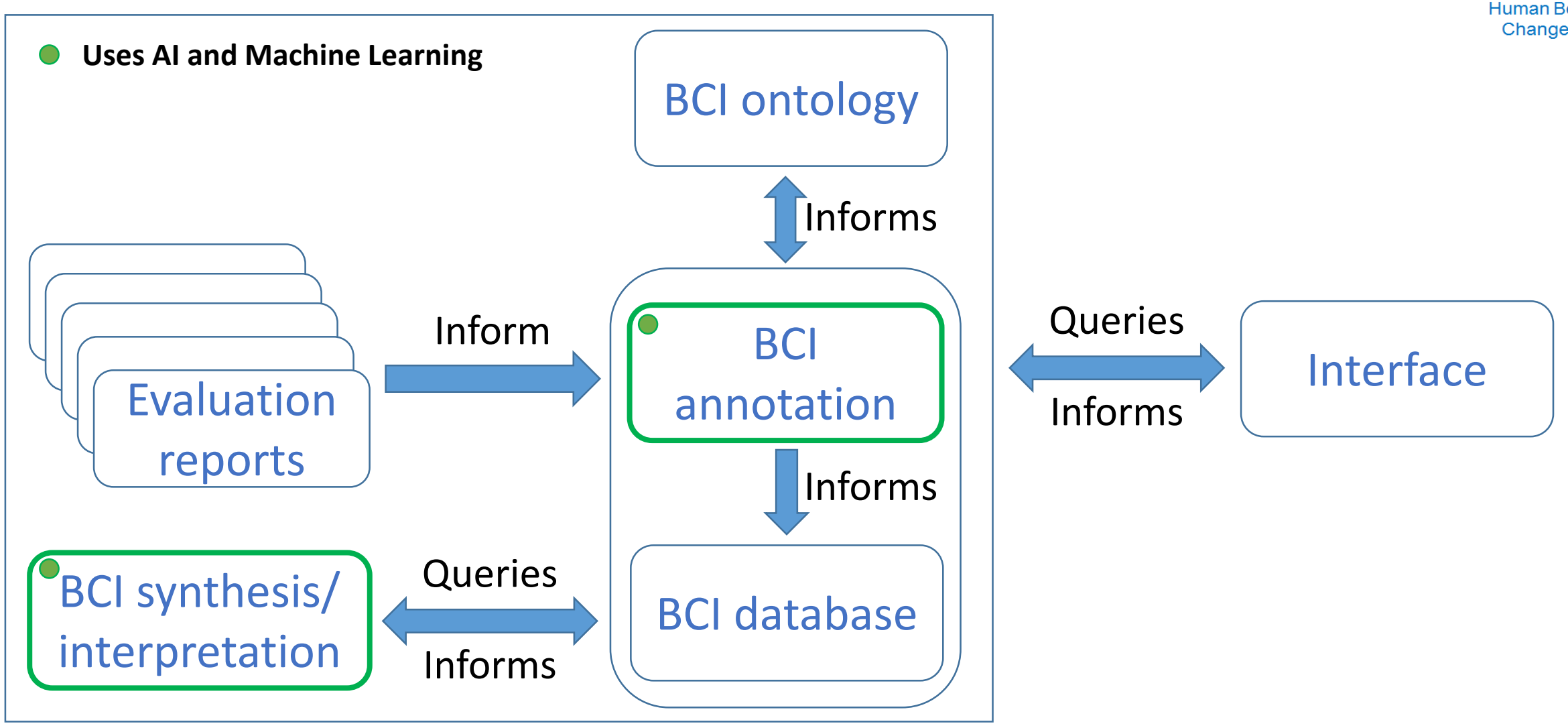

Impact: examples of Users of the System

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Inform

Query & Inform

Users

Behavioural scientist

E.g. what mechanisms of action are likely to account for the effect of x on y?

Public health policy-maker

E.g. what do I need to do to bring about this change in this population?

Detects patterns, makes inferences

The Knowledge System

Headlines

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- Using both machine learning and rule-based algorithms, the AI system will extract, synthesise and interpret relevant information
- The scale of evidence that can be analysed by these computational methods will allow the system to
  1. generate new hypotheses and advance our understanding of human behaviour and
  2. answer questions with up-to-date evidence tailored to user need and context
     - first case study smoking cessation

Michie *et al. Implementation Science* (2017) 12:121
DOI 10.1186/s13012-017-0641-5

Implementation Science

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STUDY PROTOCOL Open Access

The Human Behaviour-Change Project: harnessing the power of artificial intelligence and machine learning for evidence synthesis and interpretation

Read Supplementary Files!

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Question for moderator

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- How do you address the issue of variable quality or low grade evidence that goes into the Knowledge System?
  - Answers:
    - Makes the best use of what evidence there is
    - Able to find vastly more relevant evidence – more pattern recognition
    - Incorporates quality of evidence into recommendations/answers
    - Stimulate better reporting of evidence e.g. Paper Authoring Tools