

Systematic studies of how to optimize food waste recycling in urban communities

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... a quick ! tour ...

(many slides prepared by XU DongYin)



Starting Point 1: practice





Jepson Prairie Organics (Compost facility) Receives 600 tons per day 15 acres (60,700 m²), mostly concrete floor

What can we do with Compost? Apply to agricultural lands





Spreading compost for grape vines

What can we do with Compost? 2. Carbon storage in soils

CO2 emitted by respiration

SOIL CARBON

CO₂ absorbed

in photosynthesis

COMPOST

Carbon dioxide absorbed by grasses through photosynthesis is sequestered in the roots and surrounding soil. The compost layer increases the amount of carbon absorbed by the plants. *Illustration by Bay Nature, adapted from Whendee Silver, UC Berkeley*

Is this Composting?



Is this Composting?



We need residents to separate at source - in their homes!

New Approaches needed!

Solutions

for such modern problems require NEW WAYS OF THINKING

from YOU: The New Generation

from China: The new Consumption Leader

3 types of messages today:

10

1) DON'T blindly use old tools: master them, then...develop NEW ones

2) DON'T blindly accept Western approaches: master them, then...develop NEW ones

3) (something about waste sorting)





Common Research Question: Is INTERVENTION successful?......**YES** or **NO**??



Common Research Question: Is INTERVENTION successful?......YES or NO??

Our research question: WHY successful?





Encouraging pro-environmental behaviour: An integrative review and research agenda

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ABSTRACT

Environmental quality strongly depends on human behaviour patterns. We review the contribution and the potential of environmental psychology for understanding and promoting pro-environmental behaviour. A general framework is proposed, comprising: (1) identification of the behaviour to be changed, (2) examination of the main factors underlying this behaviour, (3) design and application of interventions to change behaviour to reduce environmental impact, and (4) evaluation of the effects of interventions. We discuss how environmental psychologists empirically studied these four topics, identify apparent shortcomings so far, and indicate major issues for future research.

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" laboratories" for in-depth experiments







What happened in the scheme?



Propaganda: Blackboard information to teach the knowledge



Facilities: waste station with labels

Shanghai "Waste Sorting" Schemes:

New communal bins + pick up service Publicity to residents Sometimes: kitchen containers given out • Or special **bags** Sometimes...incentives (soap, tissues...) Sometimes...volunteers stand beside bins at 'rush hours', to encourage residents Sometimes... **the 'cleaner' sorts** completely mixed waste...! Sometimes...an NGO is involved







Community surveys :

10 communities in total

#1,2,3,5,6,7,10,11,12,13 community

In-depth work in community

5 communities in total # 5,11,12,13, 14

e.g. Detailed work in Community 12 :

Weigh data of dry& wet waste: twice/d*3times/w*5w Composition analysis for dry waste: 2bins/d*1d/w*5w Structured interview for residents : (1h+2h) *18 Semi-structured interview for NGO: 2h+3h Semi-structured interview for CC: 2h+3h Community visit and coordinate: N Volunteer work : N Children activities Stakeholders meetings: N ²³

Successful?----YES!









But WHY?? successful?

Data Methods:

committee

Key Informants Interviews: NGO/Community

Semi-structured interviews: Residents Diary of Events

Analysis Method:

Thematic Analysis (Open Coding)

Synthesis Method:

2-D framework



Why successful?

-who will know -what we should ask -which category we should ask? Key informant interview

	Key Informant	Туре	Time
NGO	Programme director	Semi-structure	2 hours
CC	Secretary	Semi-structure	2 hours
Residents	18 residents chosen randomly	Structure	30 mins each

All interviews are recorded and transcribed before analysis



More Data

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Analysis of transcripts e.g. 12 themes





Findings e.g. 3 main points

Findings from NGO interview.

."The Glue that binds the project together": boundary spanner.

The fact that the NGO was able to slowly bring potential partners together and forge basic working partnerships was very important, as circumstances would not have facilitated it otherwise:

"The government doesn't express a very strong will to do recycling, and does not put strong pressure on subardinate units. If the government were to set up a systematic and political mechanism for a recycling scheme, such as mutual monitoring system, it will be more useful and helpful."

This was identified as the greatest overall difficulty. The NGO set up an 'Open Space' meeting for all stakeholders to generally develop their shared awareness of what was needed in order for the scheme to work. However, from the start the relative roles of the NGO with the Community Committee and the District Committee were not well defined, or indeed able to be well defined, as it was clear what the relative responsibilities were for different partners. In different communities, the dynamics and resulting actions of the NGO differed. In Community A, the Committee was very passive, not particularly cooperative and delayed events. The NGO ended up doing much of the lag work behind the tasks that nominally were 'owned' by the Community Committee:

"CC doesn't really want to engage with NGO and the recycling scheme. So, NGO, did, late, af, wark jostnat.g.GC, such as designing the information on blackhanad, and, post."

The NGO had to find a variety of ways to assist the scheme within and around the pieces of activities that were developed by other stakeholders. They were very conscious of the need to troubleshoot early on and then on a regular basis:

"We visited once every week before the launch, and made 3-4 visits every week after the launch."

Importance of the Volunteers...

Of all the activities planned in the community which directly impacted on the residents, the NGO stated that the most important was the volunteer duty standing at the bins each day:

"Some residents are touched by the old volunteers standing by the bins, regardless of tad weather, hardness and dirtiness. So they become mativated to join in the scheme. Whilst there are still some residents who are very headstrong and ignore the hard work of volunteers: the volunteers have less impact on them."

Because of the major impact of the volunteers, their training and scheduling was deemed very important by the NGO, not only in details of the scheme itself but in how to be positive,

and to nurture understanding that it is a long term transition:

"Reach them what volunteering is and the volunteer spicity, spoppy spicete with them, get feedback from them, and answer their questions. They accept the idea of recycling, and also believe that it will not be easy; maybe it will take 2-3 years for the residents to form the habk of recycling."

Partnership and relationships...

The NGO commented that they saw two kinds of residents:

"...one can be touched and change behavior. But the others are really headstrong and feel no shame when they do not (publicly) sort."

The younger residents were also thought not to recycle as much, because they are less aware about the needfor it. However, some of them had some overseas experience and did a good job.

The NGO noticed that resident participation also seemed to depend on the relationship with the Community Committee and sense of community:

"the young people are busy with work and have less need of and connection with the CC, so they don't pay much attention to the community affairs..."

Furthermore, the publicity and awareness-raising events often occurred when the young people were at work, so the NGOTelt that there was a need to design some targeted events for them. The expectation was that raised awareness would lead to much more participation with this group.

Why successful? —— from 3 points of view

NGO

- make CC interested in the scheme
- Get volunteers
- Develop relationships with CC, volunteers and residents.

Community Committee (CC)

- Make Housing Association involved
- Volunteers motivation
- Older residents trust CC and do better

Resident

- Compliance to CC
- Firm propaganda—my role
- Volunteers supervision

How to use these experience in other community? How many volunteers? Frequency of shift? What kind of propaganda? What information?



Analyzing success

Can we use a more systematic tool?

-connect across our data-connect with theories-useful for future planning





For Y-axis: a starting point

Downloaded from gualitysafety.bmj.com on November 28, 2012 - Published by group.bmj.com

ORIGINAL ARTICLE

26

Making psychological theory useful for implementing evidence based practice: a consensus approach

S Michie, M Johnston, C Abraham, R Lawton, D Parker, A Walker, on behalf of the "Psychological Theory" Group

Qual Saf Health Care 2005;14:26-33. doi: 10.1136/gshc.2004.011155

Bodground: Evidence based guidelines are aften not implemented effectively with the result that bast health automes are not achieved. This may be due to a lack of theoretical understanding of the processes. involved in changing the behaviour of healthcare professionals. This paper reports the development of a consensus on a theoretical framework hat could be used in implementation research. The objectives were to identify an agreed set of key hearetical constructs for use in (1) studying the implementation of evidence based practice and (2) developing strategies for effective implementation, and to communicate these constructs to an interdisciplinary audience

See end of ortide for authors' affiliations

Correspondence to: Dr S Michie, Centre for Orbonies Research and Effectiveness, Department of Psychology, University College Landon, Landon WCIE 7HB, UK;

Accepted for publication 12 November 2004

Methods: Six phases of work were conducted to develop a consensus: (1) identifying theoretical constructs; (2) simplifying into construct domains; (3) evaluating the importance of the construct domains; (4) interdisciplinary evaluation; (5) validating the domain list; and (6) piloting interview questions. The contributors were a "psychological theory" group (n = 18), a "health services research" group (n = 13), and a "health psychology" group (n= 30). Results: Twelve domains were identified to explain behaviour change: (1) knowledge, (2) skills, (3) social/ professional role and identity, (4) beints about capabilities, (5) beints about consequences, (6) motivation and gods, (7) memory, attention and decision processes, (8) environmental context and resources, (9) social influences, (10) emotion regulation, (11) behavioural regulation, and (12) nature of the behaviour Canclusions: A set of behaviour change domains agreed by a consensus of experts is available for use in implementation research. Applications of this domain ist will enhance understanding of the behaviour charge processes inherent in implementation of evidencerbased practice and will also test the validity of these proposed domains.

Requestly published following systematic reviews on evidence (for example, from the Cochrane collaboration with me (for example, from the Cochrane collaboration with the contrast of clinical Excellence). ecommendations for evidence based practice (EBP) are frequently published following systematic reviews of However, often evidence-based guidelines are not implemented effectively with the result that best health outcomes are not achieved.1 A practical example of the problem of implementing EBP in the area of hand hygiene is described in box L

It has been agreed that there is no "magic bullet" to changing professional practice,' and that the effectiveness of strategies is sensitive to context.1 The mixed results and the limited practical value of much of this research may be due to a limited theoretical basis for the development of interventions. The atheoretical nature of many of the interventions is unsurprising, given the large and sometimes overlapping array of psychological theories and commonent parts of theories (that is, theoretical "constructs") that could be used.

More than 230 methodologically adequate studies of the effectiveness of guideline dissemination and implementation strategies have been identified." The behaviour change methods used have been mainly intuitive or educational. These have included printed materials, audit and feedback, reminders, and educational outreach.* While small to moderate effects have been observed both within and between methods, there is no clear pattern of results favouring any one particular method.² There is also no basis for understanding which procedures are effective in which contexts because it is unclear how successful interventions have their effect-that is, what behaviour change processes are responsible for observed change. Thus, despite the large number of the accessibility and usefulness of psychological theory. The

www.gahc.com

studies, there is no basis for selecting an intervention with confidence.

Previous attempts to identify theoretical models explaining behaviour change have generated a plethora of contending theories.⁴ Various authors have suggested a range of theories that might be used," and Ashford's review identifies some 20 possible theories, each with many theoretical constructs developed within the social and behavioural sciences. There are two problems with drawing from such a large pool of theories and theoretical constructs: firstly, critical theories may be missed and, secondly, such a largen umber of theories cannot he fully applied and there is no good basis for selecting among them. Ideally, researchers should have ready access to a definitive set of theoretical explanations of behaviour change and a means of identifying which are relevant to particular contexts. In this paper we describe an attempt to reach expert consensus on which theoretical constructs should be included and applied. Bychological theories are numerous and many have

shared or overlapping constructs. Bandurat has commented on the notential for idiosyneratic selection of constructs. Constructs may be renamed to suggest different constructs or a single construct may be differentiated into multiple con structs. For example, many theories describe the individual's perception of control over their behaviour or environment. In a review of the perceived control construct Skinner* lists over 100 conceptualisations. This range of theoretical elaboration makes it difficult to know how to select and apply psychological theories.

Clarification and simplification are necessary to maximise

Table 1 Theoretical domains, component constructs, and diciting questions for investigating the implementation of evidence-

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[1] Social/perfessional rule and identity BelF-tandastki	identy Pelmicral identy/boordaries/rde Grang/wordt idently Social/grang narms Aleratias/arganisational acoustineet	What is the purpose of the griddlews? What is the purpose of the griddlews of the sacros? Do they thisk griddlews should determine their behaviour? Is doing a compatible or in carflet with professional standards/ident (prompt: manifoldlews). In this to cancerney? What is the is the in professional groups included?
(i) Belefi abas aqabilites Sef-efixaq)	Self-effaccy Control-of-behavior and institution Self-environment Provided computing Self-andrines-politikation and there Department Self-andrines Provided behavioral acentral Optimize/paintimen	Hundrid Rober ways it is for hearts duel (prompt recision) and and any appellite sphere string). What problems, how they are accessed with What would help find? What would help find? These accelerations are they for produce accessing the difficulties? These accelerations are they for produce the produce of the difficulties? How would explore difficulties due they find to do a?
[5] Babő alson accesepence. Jerősipalel ostarne/atholej	Oktore negotatás Agricula fejer Agricul Asekadul estar Agricul Asekadul estar Októre Galda cened Jahon (aranganan Balda cened Jahon (aranganan Balda de agricul asekadul estar Darda de agricul asekadul estar Sales ener al and askadul	Much show has been by each of the dot of process reduced ange of the source shows a more single source of the source process requires a source of the source process requires a source of the source process with a source process of the source process with a source process of the source proces of the source process of the source p
[6] Motivation and goals (Interface)	Interior, adoby al interior/contriby disturban Gook pistomenos, antradiek) Gook prayitation Gook prayitation Herrison and endon Cametenen Diad and practical gook Transformet andos and staps of drange	Non-mach de typ wort to de 2 Non-mach de typel hey nan de to de 2 An theor alter things hey nant to de co adaes transigi i interne Dans hey plake confit with other? An theor incerting to do c?
Pienary, attention and decision processes	Memory Altertion control Bed size molifing	k xonething bey wordly do? Will bey thick to do a? Hare much nathen will beyhow to pay to do a? Will bey neurober to do a? How? Might they decide not to do a? Might Jerompt competing to do, fine constraints]
[1] Delinemental cartest and massrow (Instrumental constraint)	Records/insterial records (a alability and nanagement) Environmental streams Person × mel records on Recording of task environment	To what extret do physical or resource fonders forditate or hinder s? An three competing tasks and two constraints? An the recessory resources confidite to those expected to under the
17 Iniai Alexan Parraj	Said agent Said agent man Said agent man Said agent Said agent Sai	To obtained a social (domainsfahran or black) company, obtain placed group, patients, shake With Beychanic also (daigo f in Social social) 27 H Beychanic also (daigo f in Social social)
(10) Envolue, Envolue)	Alka Sina Artifand reget Far Iarr-ait Gapile a sectod fitedous Tout Tout Related regets offst Arsish/depression	Ben dag verden er melorar (mjorar i in, vint? To viete niet densekol foarter laat teker af Yeer dan medar aftet a?
(11) Behasland ngolatas	Gool/noger uning hepinenstrat in Stration Artun Jarohg Sale an ataring Goolprinty Generating alematies functional Modentens of Interfordeduction gap Neiget conceptuates Engines and Indiates	What propertiesy upon an wooded to do a? forenet in individual or cognicational) An theoremediance ways if working for eccentrys?
(12) Hatare of the bahaviours	Radine/ostanostic/holdt Banding/hold Daris equations/post laboutour Representation of tasks Stops of droge model	What is the proposed balantises (§2) What we have been as the set of the set



17 theories 128 construct

12 domains



Operationalising for our context

1	知识 Knowledge	了解垃圾分类的存在,知道怎么分类,理解废弃物回收的作用
2	技能 Skills	实际操作能力,具有进行垃圾分类的实践能力
3	对能力的信任 Belief of Capability	认为自己/他人/集体有能力可以完成该行为
4	对结果的信任 Belief of Consequence	认为自己的行为将会导致不一样的结果或对结果有影响,包含长 期、短期,真实结果和认知结果。
5	社会共识 Norms	认知层面:身边的主流价值观认为什么行为是好的,是值得做的; 行动层面:周围人在做什么
6	提示与注意力 Prompts and Decisions	用以加强人们的记忆力,提醒人们完成该行为的事物
7	设施与资源 Facilities and Resources	必要的设备和人员,确保行为的发生
8	角色 Role Clarification	各参与方都认识到自己和他人承担的角色的责任与义务
9	行为规划 Action Planning	为了完成行为而组织进行的规划:个人/家庭/整体层面的规划
10	动机 Motivation	让人们开始进行该行为的动机
11	情感 Emotion	与活动或行为变化相关的情感
12	行为变化阶段 Evolutionary Stage	过去的经历或历史事件对行为变化的影响



Why successful? —— by 2D Analysis

	Stakeho lders' meeting	Propaga nda	Bin distrib ution	Volunteers shift	Incentives	Children activities	Waste station reconstruction	Bin labels	Media report	Study visit
Knowledge		✓		✓		✓		\checkmark		
Skills				\checkmark		\checkmark				
Belief of Capability	✓	✓								✓
Belief of Consequence		✓							\checkmark	\checkmark
Norms	\checkmark	\checkmark		\checkmark		✓			\checkmark	✓
Prompts and Decisions		✓		✓	✓	✓		\checkmark		
Facilities and Resources			✓				\checkmark	✓		
Role Clarification	\checkmark	\checkmark		✓						✓
Action Planning	✓									
Motivation		\checkmark		\checkmark	\checkmark				\checkmark	\checkmark
Emotion				\checkmark		\checkmark				\checkmark
Evolutionary Stage										✓



Why successful? —— by 2D Analysis

	Stakeho lders' meeting	Propaga nda	Bin distrib ution	Volunteers shift	Incentives	Children activities	Waste station reconstruction	Bin labels	Media report	Study visit
Knowledge		\checkmark		✓		✓		\checkmark		
Skills				\checkmark		✓	Ros	idan	+	
Belief of Capability	✓						Res	nach		~
Belief of Consequence		√					Complian	ce to (CĆ	√
Norms	\checkmark			~		\checkmark	• Firm propaganda,—my			
Prompts and Decisions		√		•	✓	√	Voluntee	rś—		
Facilities and Resources			\checkmark				✓ CC and do			
Role Clarification	✓			✓						~
Action Planning										
Motivation		\checkmark			\checkmark				\checkmark	\checkmark
Emotion										
Evolutionary Stage										\checkmark
NGO	1		ommunit	v committe	٩	• • •	Residents			37





- 1. We can understand which aspect of each activity is really important.
- 2. We link the vertical dimension to many theories: now the practice can be related to theories.
- 3. We have develop a new method to analyze "success".
- 4. We can adapt the method to other research, e.g. to reduce energy consumption in community apartments.



Learning to take forwards

——for theory

- > 10+2 framework should be developed further.
- Linked to waste management literatures in more depth.
- Linked to behavior change theories in more depth.
- > Test in different applications for robustness.



Learning to take forwards

-for practice

- Use volunteers 2-4 hours per day, 2-3 months, to create the norm/habit of recycling, to motivate residents, to influence residents by emotion
- Train volunteers
 Be positive, be knowledgeable, be helpful
- Clarify roles well
 Early meetings of stakeholders
 Firm official message to residents
- Check all the 12 determinants to be taken care of

'door-stepping teams' – WHY successful?



WHY successful?





Why successful? —— by 2D Analysis

	Stakeho lders' meeting	Propaga nda	Bin distrib ution	Volunteers shift	Incentives	Children activities	Waste station reconstruction	Bin labels	Media report	Study visit
Knowledge		✓		✓		✓		✓		
Skills				✓		\checkmark				
Belief of Capability	✓	✓			Resources, Co Contents lists	nservation and Recycling 73 (20) s available at SciVerse Scie	13)94-103 InceDirect	Resources Conservation & Recycling		✓
Belief of Consequence		√		ELSEVIER	Resources, Co	onservation an	d Recycling		 Image: A second s	√
Norms	\checkmark	\checkmark		Door stepping as	a strategy for im	proved food wa	ste recycling behaviou	r	~	\checkmark
Prompts and Decisions		√		Evaluation of a fu A. Bernstad ^{a,*} , J. la Co	Door-stepping as a strategy for improved food waste recycling behaviour – Evaluation of a full-scale experiment A. Bernstad ^{a,*} , J. la Cour Jansen ^a , A. Aspegren ^b					
Facilities and Resources			~	^b VÁSYD, Box 191, 20121, Malmó, Sv ARTICLE INFO	A B S T R A	ст				
Role Clarification	\checkmark	\checkmark		Article history: Comparisons were made between two groups of households in a multi-family residential area in order to nevestigate how oral information through a door-stepping campaign can influence household food waste recycling behaviour from a quantitative as well as qualitative perspective. Source-separation behaviour 13 December 2012 13 December 2012 was assessed both through weakly weighting of all source-separated food waste and dry recyclables as Accepted 14 December 2012 well as residual waste generated over a period of 104 weeks, as well as repeated waste composition analyses. Introduction of source-separation of food waste for biogas norduction similicantly decreased						\checkmark
Action Planning	✓			Keywords: inalyses. Introduction of source-separation of robod waste for biologa production significantly decreased the generation of residual waste in the whole case-study area. An average generation of 0.72 and 0.71 kg. Information Door-stepping Information incursion incursion						
Motivation		\checkmark		separation ratio of food waste amongst households receiving oral information suggests a low durability of the door-stepping campaign. No signs were seen of increased source-separation ratio or diccreased ratio of incorrectly sorted material amongst dry recyclables. The study supports previous findings pointing at accessibility as a key factor for increased recycling behaviour. However, results also suggest that such systems must address convenience also in the household interior. © 2012 Elsevier B.V. All rights reserved.					\checkmark	\checkmark
Emotion										\checkmark
Evolutionary Stage										\checkmark







Why successful? —— by 2D Analysis

	Stakeho lders' meeting	Propaga nda	Bin distrib ution	Volunteers shift	Incentives	Children activities	Waste station reconstruction	Bin labels	Media report	Study visit
Knowledge		✓		\checkmark		✓		✓		
Skills				\checkmark		\checkmark				
Belief of Capability	✓	✓								✓
Belief of Consequence		✓							\checkmark	\checkmark
Norms	\checkmark	✓		\checkmark		✓			\checkmark	\checkmark
Prompts and Decisions		√		✓	✓	~		 ✓ 		
Facilities and Resources			~				✓	~		
Role Clarification	✓	✓		✓						✓
Action Planning	✓									
Motivation		✓		✓	✓				✓	✓
Emotion				✓		✓				✓
Evolutionary Stage										\checkmark

Are NGOs useful partners? WHY?

Research Question: Is involving informal partners useful or.... costly diversion of resources?

- Heidrich et al., (2009) NGOs are not vital and of low importance for waste management systems
- While other studies discuss the advantage of involving such organisations (Ahmad and Ali, 2006; Colon & Fawcett, 2006; Muller & Hoffman, 2001; Sharholy et al., 2008; Suttibak and Nitivattananon, 2008; Tukahirwa et al., 2013)

YES: they are useful...WHY?

	Food Waste Recycling Rate (%)	Contamination Levels (%)
No NGO Involvement		
Community 'A'	0	100
Community 'B'	0	100
NGO Involvement		
Community 'C'	68	<1
Community 'D'	48	<1

WHY? Here's why...

-			
Behaviour Change	No NGO	NGO	
determinants	involvement	involvement	
Knowledge	\checkmark	✓ ✓	
Skills		$\checkmark \checkmark \checkmark$	
Roles		$\checkmark \checkmark \checkmark$	
Capabilities Belief		\checkmark	
Anticipated outcomes		\checkmark	
Motivation		\checkmark	
Memory & Attention	✓	\checkmark	
Facilities	\checkmark	$\checkmark \checkmark \checkmark$	
Norms	✓	\checkmark	
Planning	*	\checkmark \checkmark \checkmark	
Contextual Determinants			
Emotion		* *	
Nature of the	✓	✓	
Behaviours			

WHY? Connecting with theory...

- Able to smooth decision-making processes
- Ensured action planning took place
- Developed the skill capacity of local organisers and cleaners to deliver the scheme competently
- Created new norms
- Kept overall associated emotions positive

By involving wide circles of committee members, associations, new volunteers and residents the NGO established a new culture of recycling

Useful for planning?

knowledge

belief of capability

role clarification

action planning

evolutionary stage

motivation

emotion

belief of consequence

prompts and decisions

facilities and resources

skills

norms

pre-scheme

post-scheme







Our new determinants will link those in both disciplines and to practical indicators



Shanghai Composting (small scale system)





Sustainable Behavior Research Group