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ABSTRACT

This paper presents an empirical comparison of idea generation within the context of reducing the number of single occupancy car journeys to and from a UK university campus. Separate co-design and consultative groups were matched with respect to (1) creativity when problem solving, (2) normal commuting mode and (3) intention to adopt sustainable behaviours. The co-design group generated a significantly greater number of innovative ideas than the consultative group (using an email-based methodology); however, this was due to the greater number of total ideas (rather than the higher proportion of innovative ideas) generated by this group. The co-design group was able to think more systemically about potential solutions and generate proposals that were not either linked to their own commute mode, or aligned with any one specific mode of transport. The findings suggest that co-design offers benefits as a process for idea generation within the sustainable travel context as it promotes idea generation and a more holistic perspective on the problem and potential solutions.

1. Introduction

1.1. Collaborative consultation within transport

User involvement in transport decision-making (often referred to as 'public participation') has been actively encouraged by government for many years (Cramton 1971; DETR 1998, 2000). However, assessments of consultation processes indicate that the methods used for engaging the public are mostly traditional (e.g. questionnaires, consultation documents and focus groups) with very little use of creative techniques reported (Bickerstaff, Tolley, and Walker 2002; Wagner 2013). Furthermore, early involvement of end users in problem identification was only included in half of the consultation processes reviewed, with the level of involvement in half of these being assessed as 'passive' (i.e. agreeing pre-established local authority priorities) rather than 'active' (i.e. generation of problem areas, priorities or potential solutions).

Development of sustainable transportation polices and services is invariably a 'wicked problem' (Coyne 2005; Wahl and Baxter 2008). This is a term first introduced by Churchman (1967), and then formally described by Rittel and Webber (1973) to describe problems in social policy that do not lend themselves to definitive solutions because the problem space is ambiguously defined, and there are many stakeholders with conflicting values. As a result, design agencies are increasingly being commissioned to apply 'design thinking' to such areas (Brown 2008; Burns et al. 2007; Fuad-Luke 2009), with the objective of raising awareness of issues with stakeholders, generating more innovative solutions to the complex problem space and contributing to conflict resolution (Levine 2009). This has raised the overall profile of creative, user-centred design approaches within organisations.

Bradwell and Marr (2008) define co-design as a broad 'umbrella' term that refers to design processes that seek 'to combine the views, input and skills of people with many different perspectives to address a specific problem'. They conducted an international survey of co-design practice within 466 public service providers across a range of sectors, and found the transport sector to be 'remarkably open to some elements of co-design', but that organisational cultures were more geared to supporting traditional top-down rather than more collaborative design practices.

Despite the growing enthusiasm for co-design processes amongst policy-makers and practitioners, little empirical research exists to assess the impact of such creative processes upon the generation of ideas by members of the public (Kristensson and Magnusson 2010). Steen, Manschot, and De Koning (2011) identified through a literature review and a series of case studies that improved idea generation was a key benefit of co-design. However, there is a general lack of robust evidence to support the premise that individuals generate more ideas and in particular, more original ideas, when utilising creative approaches compared to when ideas are elicited using a more traditional consultation processes.

A series of related New Product Development studies investigating the generation of ideas for future information and communication technology (ICT)-based services found that involving ordinary users at the front end of the design process resulted in the generation of both radical and incremental ideas for new products, and that in certain circumstances ordinary users contributed more original ideas than company experts (Kristensson and Magnusson 2010; Kristensson, Magnusson, and Matthing 2002). A prerequisite for successful idea generation was found to be 'use experience': direct experience of the problem space being addressed.

Witell et al. (2011) compared idea generation resulting from the application of traditional 'passive' market research techniques with those generated using more 'proactive' co-creation research tools. The context was the design of a new microwave oven. They found that a higher number of original ideas were produced by users who used the co-creation tools than those who took part within conventional focus groups. They concluded this was because idea generation by the co-creation participants was more actively grounded in consideration of specific problematic instances of use rather than based upon more general discussion of user needs.

Steen, Manschot and De Koning (2011) argue that further co-design research is needed to assess whether the benefits expected from utilising a co-design process are actually realised. Mirroring the earlier conclusions of Roser and Samson (2009) they conclude that Key Performance Indicators (KPIs) such as the number of new ideas for products/services and their originality could be used to assess the effectiveness of utilising a co-design approach.

The study reported in this paper attempts to empirically measure the benefits of utilising a co-design approach in relation to these two key KPIs.

1.2. The study context

The purpose of this study was to generate proposals for reducing the number of single occupancy car journeys to and from Loughborough University campus, in the UK. At the time of a campus-wide travel survey at the university, 56% of all staff drove a car alone to work (i.e. single occupancy), and only 14% walked and 11% cycled. In addition, although there were few vehicle-related accidents in and around the campus, there were traffic management and real estate planning conflicts between car drivers, cyclists and pedestrians. In line with the characteristics of 'wicked problems' the university travel planners had found that there were therefore no obvious solutions due to multiple stakeholders, and differing world views and preferred solutions.

1.3. Study aims

The study aimed to investigate empirically the benefits of using a creative idea generation process within a sustainable transport project context. Two specific objectives were:

- To design and undertake a study that enabled *empirical comparison* of the ideas generated by 'co-design' methods with those generated using a more traditional email-based consultative process.
- To compare the number, innovativeness and scope of ideas generated by the two participant groups.

2. Methodology

2.1. Awareness raising and participant recruitment

An established principle of co-design is the assumption that all people are creative and will participate in a creative process if they are motivated and provided with the tools to do so (Sanders and Stappers 2008). Stage 1 of the study was therefore to raise awareness of the single occupancy car problem and to create a desire to contribute towards solving it. The travel survey data (which included travel times, departure and destination locations and modes of transport) was used to create an animated visualisation of the morning commute journeys of all 1904 staff that provided their home postcodes when they completed the travel survey (Figure 1).

Co-design groups should contain a diverse range of participants in order to encourage learning and reflecting on each other's experiences (Björgvinsson 2008). If the backgrounds, 'world view' and opinions of the participants are too homogenous then any outcomes may be limited and even predictable (Mulder and Stappers 2009). Therefore, this visualisation was made available to all staff via the front page of the university website to both raise awareness of the problem, and to recruit potential participants for the study. The wording associated with the visualisation did not make specific reference to sustainable transport in an attempt to attract a heterogeneous participant sample in relation to their sustainability 'world view'.
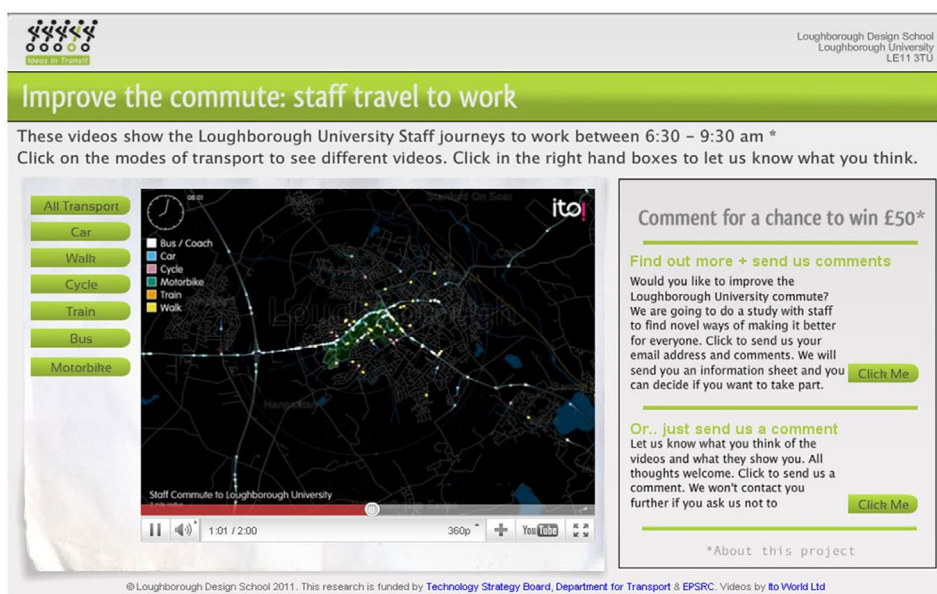
Figure 1. Visualisation of travel to work data.
Note: Available here in archive form: http://www.youtube.com/ideasintransit

Table 1. Characteristics of each group, as initially recruited.

		Co-design group (*n* = 17)	Email group (*n* = 15)
Commute mode:	Car	6	5
	Train	1	1
	Bike	6	5
	Walk	2	2
	No predominant mode	2	2
Mean Ideator score (range)		34.9 (25–43)	32.8 (22–41)
Mean intention to change score (range)		3.5 (2.7–4)	3.5 (2.7–4)

2.2. Participant matching

The recruitment process aimed to create two matched participant groupings which were balanced in terms of traits that would influence their idea generation in relation to sustainable travel. Individuals who visited the website and offered to take part in the study were sent a screening questionnaire. This enabled matching of groups based on the following criteria:

(1) Commuting mode. This was categorised as mode of transport based on that most frequently used by the participant to commute to work.
(2) Attitudes to climate change and intentions to change with respect to sustainable behaviours adapted from DEFRA (2008).
(3) The individual's natural propensity for creative problem solving. This was assessed using the Foursight online 37-question survey (Puccio 2002), which determined their natural inclination towards discrete problem solving roles, described as 'Ideator', 'Clarifier', 'Developer' and 'Implementer'. To avoid biasing the responses of the participants, the participants were asked to complete all four elements of the Foursight tool, and were not told that we were specifically interested in the idea generation aspect. The score on only the 'Ideator' scale was used in the matching process.

Table 2. The stages of the study (chronologically) and the nature of participation for each group.

Stage	Co-design cohort	Email cohort
Pre-screening (capture of information to enable matching of groups)	Sent out and received by email and online (Foursight survey)	
Story creation (initial stage of 'sensitisation')	20–30 min face-to-face individual interview to elicit each 'journey to work experience' and create a storyboard	Not applicable to the email group
Problem and context setting	Context and problem described at the start of a collaborative session	Stated in written form and emailed to participants
Story sharing (second stage of 'sensitisation')	Participants shared the story sheets of their 'journey to work experiences'	Not applicable to the email group
Problem understanding (joint development of the context/problem)	Brainstorming of barriers and enablers to solving the problem	Not applicable to the email group
Idea-generation	Brainstorming of ideas to solve the problem. The final element of the collaborative session with participants	Prompted and returned by email (typical of a traditional travel plan survey approach)
Reflection (post idea generation feedback from participants)	A subsequent 10 min face-to-face interview enabling participant feedback	Email-based query covering the same issues

In order to create two matched cohorts, the participants were first grouped according to most frequent mode of transport. For each mode of transport, pairs of participants were created, where each individual within a pair had an equivalent (or closest possible) score on the 'Ideator' scale. Finally, each of the two groups resulting was placed in order of their 'intention to change' score, and checked for broad match. This process resulted in matched pairs of participants. They were then randomly allocated to the co-design and email groups. The matched participant groups had the characteristics shown in Table 1. Due to drop out at the recruitment stage, the participant numbers recruited initially for each group were slightly uneven.

2.3. Study design and procedure

The research was based around empirical comparison of idea generation by two matched cohorts. One cohort (termed 'email') comprised individuals who were communicated with by email (without any control over their location) in a manner typical of a travel consultation. The other cohort (termed 'co-design') was brought together as groups, and undertook a collaborative idea generation process. Both activities occurred over the same time period, to help ensure that both groups were exposed to the same external influences such as workplace travel initiatives, news stories, seasonal weather changes and holiday periods. Each cohort was given the same general background information and instructions; the co-design group had the addition of sensitisation and collaborative idea generation activities. Sensitisation and ideation are the key initial stages within many co-design processes (Visser et al. 2005) and are described further below. The protocol is summarised in Table 2, and the individual stages are described in more detail below.

2.3.1. Problem and context setting (email and co-design groups)

Although the delivery mechanism differed (see above), the context framing was the same for both groups. The university wished to reduce single occupancy car journeys, but it was also highlighted that there may not be one preferred solution due to the range of constraints and
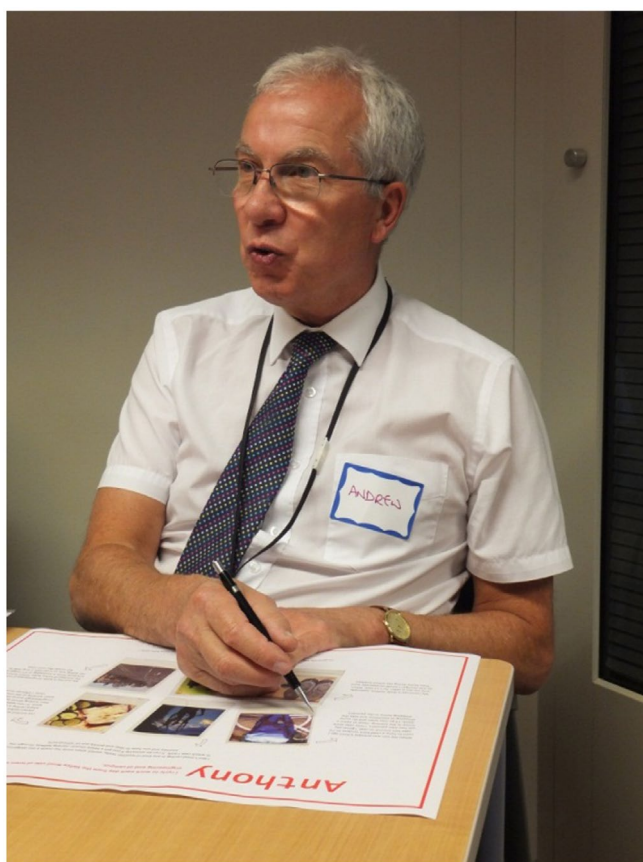
Figure 2. Story sharing within the co-design group.

individual preferences. For the co-design group, the problem and context were described as the first activity of the collaborative session. Each co-design participant attended one of four sessions which were facilitated by a team of three researchers and lasted approximately two hours. For the email group, the context and problem were set out in written form and emailed to them.

2.3.2. Story telling (co-design groups) – creation and sharing

The story telling aspect for the co-design group consisted of *story creation* and *story sharing*. Mulder and Stappers (2009) highlight the need to focus on the design of experiences rather than the design of individual products or services. Furthermore, there should be an emphasis on understanding the whole of an experience not just an episode or single touch point. Storytelling, often a key component of co-design studies, was the natural vehicle for capturing and sharing experiences (Battarbee 2003; Levine 2009) and also provided a means to sensitise participants to the problem space (Visser et al. 2005). Via individual face-to-face interviews, each person in the co-design group was asked to consider how they felt about their whole journey to work experience and not just the logistics of the journey. The main points were used to create a visual storyboard for the individual. This was then

shared with the participant who was given the opportunity to correct or amend the content to better reflect their experience.

The story sharing began with the boards being randomly allocated to another group member who shared the other person's story with the group (Figure 2). The storyteller was encouraged to be non-judgemental but to ask questions of the story owner whenever they were unsure or curious about the content. After the stories for the whole group had been shared, the boards were displayed on the wall and the participants collaboratively identified and marked similarities and differences between their own journey experience and those of others.

2.3.3. Problem understanding (co-design group)

Participants were next reminded that the purpose of the session was to generate ideas or potential solutions for reducing the number of single occupancy car journeys to and from the campus. The facilitators prompted the participants to think beyond their own perspective and experience. Their attention was drawn to the range of different experiences evident from hearing other peoples' stories, and participants were encouraged to consider the needs of other colleagues who work at the university. They were then asked to generate the barriers and enablers faced by staff when commuting to work and how these impact on their choice of transport mode. They were prompted to think about the journey as an experience that offers potential benefits and drawbacks, not just getting from A to B. For example, living on a direct bus route will enable use of public transport, but the opportunity for regular exercise is also an enabler that may motivate someone to take up cycling. The barriers and enablers were then clustered according to the theme.

2.3.4. Idea generation (both groups)

Within the co-design group, the barriers and enablers (above) were then rephrased as opportunities represented by 'How might we (HMW) …?' statements (IDEO 2009). An example would be 'How Might We provide flexibility for people who need to pick up and drop young children whilst reducing single occupancy car travel?' The aim was for participants to generate at least one HMW statement for each barrier and enabler; see Figure 3.

The final stage of the workshop was a prompted brainstorm session based around these HMW statements. Standard brainstorming rules were introduced to encourage the non-judgemental participation of all group members as well as encouragement of all ideas however unusual. Three HMW statements were selected by the group to start idea generation. Two sets of prompts were additionally used. Firstly, the participants were prompted to consider things that Loughborough University could do, things individual staff members could do and then things people could do together. Participants were asked to consider how ICT could enable future services. Secondly (and to help avoid fixation on current technologies), they were also prompted with a series of WHAT IF questions. For example, 'what if you could know more about other people, such as where they live etc.?' When ideas dried up, further HMW statements were introduced. All ideas generated during each workshop were summarised on sticky notes as they were generated, and labelled according to which individual had first generated that idea.

The idea generation phase for the email participants mirrored the process typically used in a traditional travel plan survey approach. The background and problem statement were set out in the same terms as the co-design group, and communicated to them by email.

Figure 3. Generation of 'How Might We' statements within the co-design group.

Table 3. Summary of innovation assessment categories for each idea.

Level	Categorisation	Definition
Global	Not innovative	All experts that assessed that idea had seen it tried or implemented
	Innovative	All experts that assessed that idea had not seen it tried or implemented
	No consensus	The experts were not unanimous in their assessment
Local (University)	Implemented	The expert had seen it trialled or implemented at Loughborough University
	Mentioned only	The expert had seen it mentioned or proposed (but not trialled or implemented) at Loughborough University
	Innovative	The expert had not seen it trialled, implemented, mentioned or proposed at Loughborough University

These participants were asked to reply by email, in any format, providing ideas to solve the problem described to them. They were free to reply in their own time, but were asked to undertake the activity alone. Pointers were provided as per the brainstorming rules above, and the same two sets of prompts were also provided by email.

2.4. Method for categorisation of ideas

The primary aims of the study were to analyse the number, innovativeness and breadth of the ideas generated by the two participant groups. As well as a total frequency count, all ideas were additionally categorised in terms of their relevance to the participants own

mode of transport (e.g. car schemes proposed by car commuters), other transport modes not utilised by them (e.g. bike lane schemes proposed by car commuters) and generically applicable ideas (e.g. more flexible working based around transport options). This provided an indication of whether the idea generation process (co-design or email) participants to think more systemically rather than focus solely on their own needs.

Innovativeness was evaluated by experts in relation to: (1) a local perspective, and (2) a global perspective, reflecting the view that innovation can be defined in relation to the perception of its unit of adoption (Zaltman, Duncan, and Holbek 1973) or application context (Blake and Hanson 2005).

Innovation at a *local level* was defined in relation to sustainable travel at the university. All of the ideas generated by the participants in both groups were assessed by an expert in Loughborough University's workplace travel plan team according to whether they had, within a commuting and sustainable transport context at Loughborough University: (a) seen it implemented (including as a pilot); (b) seen it mentioned or proposed; or (c) neither.

The evaluation of each idea at a *global level* used a two-stage process. A first filter based on the expert judgement of two transport researchers, plus a detailed web search identified those ideas that were definitely not innovative since examples of their development or application could be found elsewhere in the UK, or internationally. The remaining ideas were sent to four independent transport behaviour experts not associated with the research or the university, each of whom had at least 10 years international experience relating to design and implementation of travel interventions for sustainable behavioural change. The four experts were asked to separately assess each idea according to whether they had 'seen' it (either the UK or internationally) or 'not seen' it. 'Seen' was defined as an idea they had seen tried/implemented, not just proposed. In addition, it had to have been tried/implemented specifically for commuting in a sustainable travel context, i.e. consistent with innovation being defined based on application within a context rather than merely an activity. Therefore, some of the ideas generated may have been used for another purpose (e.g. as a health intervention or to enable work/life balance), but not to address sustainable travel problems.

The resulting rating categories are shown in Table 3. For assessment of innovativeness at the global level, a 'no consensus' category was used to categorise those ideas where there was a lack of consensus amongst the travel experts.

3. Results

3.1. Number of ideas generated

As each idea that was generated by an individual in either group had been referenced to that individual, the total number of ideas generated per person could be compared between the email and co-design groups. All ideas were initially included, excluding where an individual had essentially proposed the same idea more than once. Following the recruitment stage, there was some dropout in both groups (due mostly to job changes). This resulted in a total of 98 ideas being generated by 12 participants in the email group and 201 ideas being generated by 16 individuals in the co-design group.

Figure 4 shows a boxplot of the distributions of the number of ideas generated by each individual in the email and co-design groups. The shaded box shows the median (Md) and interquartile (IQ) range (i.e. central 50% of the data). The whiskers extending from the end
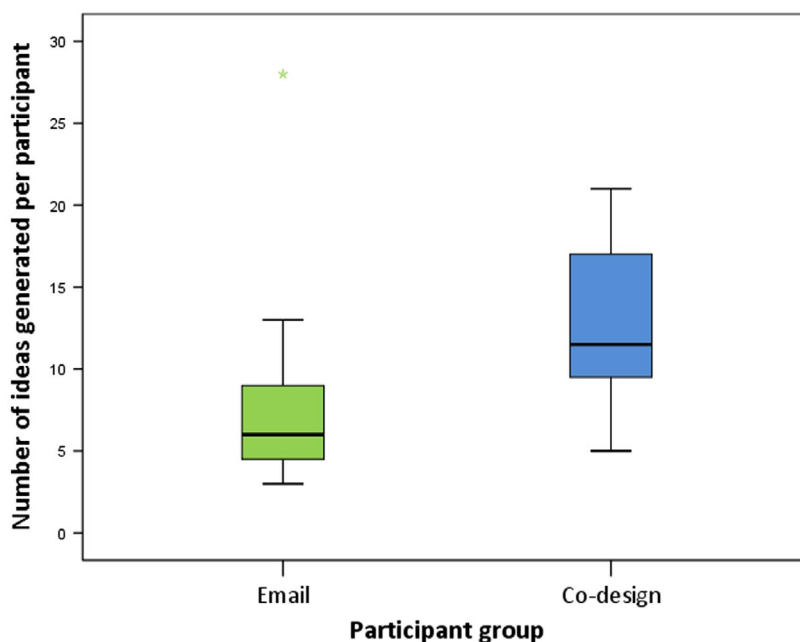
Figure 4. Distribution of number of ideas generated per individual in each participant group.

of each box show the largest and smallest observed values that are not statistical outliers. Outliers (at a distance of between 1.5IQ and 3IQ from the end of the box) are shown with a circle, and extreme values (>3IQ) with an asterix. It can be seen that neither sample was normally distributed, and that the data for the email group in particular was positively skewed.

A Mann–Whitney independent samples non-parametric test showed that the co-design group (Md = 11.5) generated significantly more ideas per individual than the email group (Md = 6), ($N = 28$, $U = 154.0$, $z = 2.70$, $p = .006$, $r = .51$). The value of r is a large effect size according to Cohen (1988). This analysis includes duplicates due to more than one individual in the email or co-design groups coming up with the same idea.

A similar analysis was undertaken to investigate whether there were differences in the two groups according to whether the ideas generated related specifically to their own mode of transport, specifically to a different mode, or were ideas that were applicable to diverse modes of transport. A Mann–Whitney U Test revealed no significant difference between the email and co-design group in the number of ideas relating to a participant's own mode of travel ($N = 28$, $U = 124.5$, $p = .189$) or that of another specific mode of travel ($N = 28$, $U = 83.50$, $p = .568$). However, there was a significant difference between the email groups (Md = 0, $N = 12$) and co-design groups (Md = 5.50, $N = 16$) in the number of sustainable transport ideas applicable to more than one mode of transport (Mann–Whitney, $N = 28$, $U = 174.0$, $z = 3.663$, $p < .0001$, $r = .69$). This represents a very large effect size in accordance with Cohen (1988).

A χ^2 statistic was used to compare the total number of unique ideas generated by the two groupings, i.e. discounting duplicates where more than one participant in a group had proposed the same idea. This was based on 51 separate ideas being generated by the email group, and 110 by the co-design group. Chi-square also requires that each unit of analysis
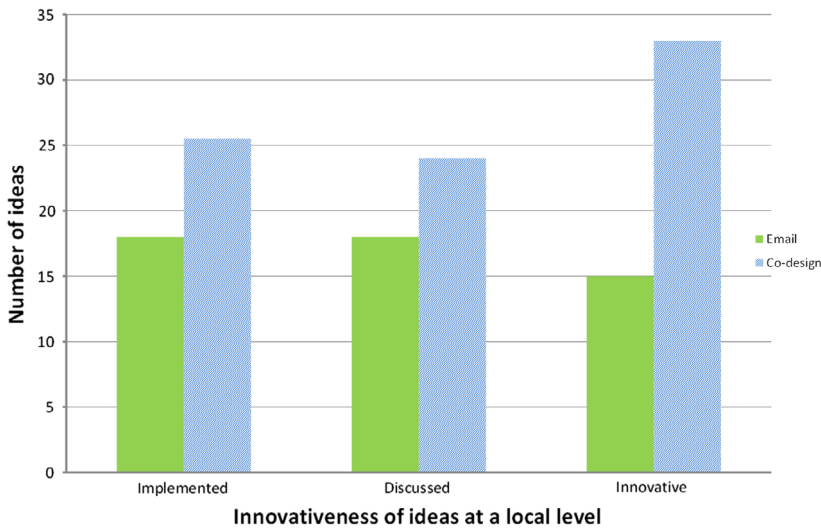
Figure 5. Innovativeness of ideas at a local level, including scaling factor. Note: Note that the bars for the co-design grouping have been reduced by 25% to enable visual comparison based on equivalent sample sizes of $n = 12$.

appears only once in each cell of the contingency table. Therefore, 21 ideas that were generated by both groups were also removed from the analysis, leaving 30 ideas that were only generated by the email group, and 89 ideas only generated by the co-design group. A χ^2 analysis for goodness of fit[1] (adjusting expected values due to the differing sample sizes of email ($n = 12$) and co-design ($n = 16$)) showed that the email group generated significantly fewer ideas unique to that group than the co-design group ($\chi^2(1) = 15.13$, $p = .0001$).

3.2. Innovativeness of ideas generated: local perspective

The innovativeness of the ideas at a local level was assessed by a travel expert in the university's travel team using the procedure described in Section 2.4. At a local level 15 ideas from the ($n = 12$) email group, and 44 ideas from the ($n = 16$) co-design group were judged as innovative. Figure 5 shows the local innovativeness of the ideas generated by the email and co-design groups, including within each group those ideas that were also generated by the other participant grouping. The bars for the co-design group have been scaled by .75 to enable visual comparison of equivalent group sizes of $n = 12$.

To satisfy the requirements for the Chi-squared analysis, as above, 21 duplicates appearing across both participant groups were removed. The 'implemented' and 'discussed' groups were combined to create a non-innovative category and compared using χ^2 with the 'innovative' group. This showed that there was no significant difference in the *local innovativeness* of the ideas generated by the email or co-design groups $\chi^2(1) = .046$, $p = .876$. An idea generated by either the email or co-design group was equally likely to be innovative within the local context. However, because the co-design group generated more ideas per se (even after taking into account the larger sample size), there were a greater absolute number of innovative ideas generated by the co-design group.
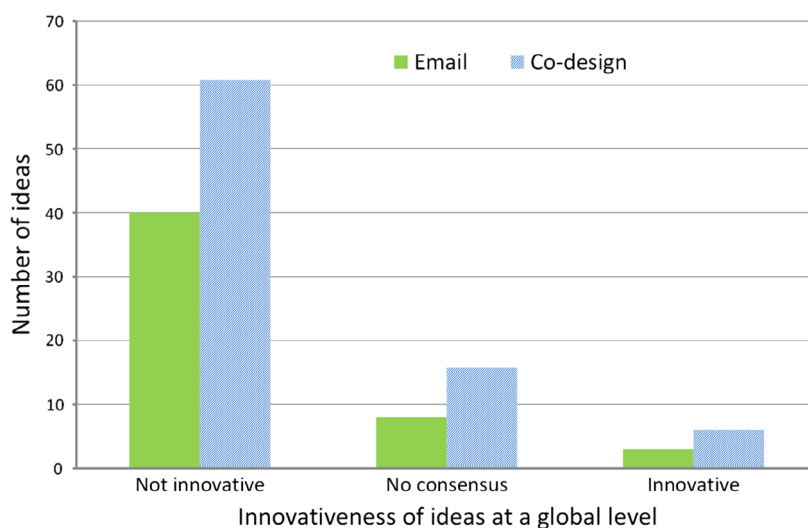
Figure 6. Innovativeness of ideas at a global level, including scaling factor. Note: Co-design grouping bars scaled as above.

3.3. Innovativeness of ideas generated: global perspective

At a global level three ideas from the ($n = 12$) email group, and eight ideas from the ($n = 16$) co-design group were judged as innovative. Figure 6 shows the innovativeness at a global level of the ideas generated by the email and co-design groups, including within each group those ideas that were also generated by the other participant grouping. As above, the bars for the co-design group have been scaled by .75.

Ideas generated by both the email and co-design groups were removed as before, to ensure mutual exclusivity for cases in cells, and the 'Not innovative' and 'No consensus' groups were combined to create a non-innovative group. A chi-squared goodness-of-fit test indicated that there was no significant difference in the *innovativeness* of those ideas generated at a national/international level by the email or co-design groups, $\chi^2(1) = .024$, $p = .830$. As for the analysis at a local level, an idea generated by either group was equally likely to be innovative at a national/international level. Similarly as before, the greater number of ideas generated by the individuals in the co-design group did result in more innovative ideas being proposed by that group.

4. Discussion

The study set out to explore within the context of a sustainable travel project whether utilising a co-design approach increased the number, originality and breadth of ideas generated in comparison to using a more traditional email-based consultative approach.

Steen, Manschot and De Koning (2011) highlight that although the benefits of utilising co-design in as a means to improve idea generation is reported, more empirical evaluation of its effectiveness is needed. The co-design approach did generate significantly more ideas per individual than using an email-based consultation with individuals. When comparing the nature of the ideas created, there was no significant difference in the number of ideas

created, either in relation to their own mode of transport, or another specific mode of transport. The key difference between the two groups was the ability of the co-design group to think more broadly about potential solutions and generate proposals that were not either linked to their own commute mode, or aligned with any one specific mode of transport. Whereas ideas created by the email-based group tended to reflect more standard solutions (e.g. relating to parking initiatives), the co-design group generated significantly more ideas related to a broader context, such as referring to transport policy, incentives, provision of information or modifications to work/life routines. Many of the additional ideas created by the co-design group demonstrated unconventional framing, for example, a scheme that rewarded slow cycling as a means of burning fat as well as travelling sustainably.

Although there were highly significant differences in the *number* of ideas generated by the two groups, there was no difference in the innovativeness of the ideas that were generated. An idea generated by either group was equally likely to be innovative, either within a local or global context. However, in terms of the ability to generate innovative proposals within the application domain (sustainable transport), the participative approach *was* more successful than the email-based consultation – since they generated a greater *total*, and hence a larger number of innovative ideas.

Two tests for 'innovative' were used within this study. The test at the global level was considerably more stringent than the test for local innovativeness, both due to the wider geographical and application context, and requiring that *none* of the four experts had seen a proposal in order for it to be judged as 'innovative'. Only three ideas from the email group ($n = 12$) and eight from the co-design group ($n = 16$) were judged as innovative at the national/international level.

In comparison, 15 ideas from the email group, and 44 from the co-design group were judged by the travel consultant as innovative within the context of sustainable travel at Loughborough University. The data therefore shows that approximately five times as many ideas were generated that were judged as locally (rather than internationally) innovative – these were ideas which had been seen within an international context but not applied to the local problem of interest. This difference in local and global innovativeness demonstrates the value of actively looking for global examples of innovation, that could be applied (and be innovative) within a specific, local, context.

The co-creation activities included in the co-design workshops were chosen to focus on understanding the problem before seeking to generate ideas to solve the problem, in line with established co-design methodologies (IDEO 2009; Visser et al. 2005). The outcomes of the workshop suggest that focussing on problem definition succeeded as a way of increasing the number and breadth of ideas generated.

The researchers acted as facilitators (Sanders and Stappers 2008) within the workshops – whilst restraining from participating directly in idea generation. However, the facilitators were painfully aware of the opportunities to generate innovative ideas that were lost through the need to maintain empirical rigour. They were unable to: (1) propose ideas themselves, (2) use their specialist knowledge of the capabilities of future ICT to stimulate further ideas, (3) truly co-create ideas with study participants or (4) carry over and build on ideas generated in one session into subsequent sessions. Artificially constraining the co-design process in this way is likely to have curtailed the number and innovativeness of ideas generated within the co-design group sessions. A further limitation is that the very nature of the study meant that a number of factors were likely to be contributing to the

overall differences observed between the two cohorts, and it was not possible to isolate the contribution that the *individual* factors made in terms of idea generation.

5. Conclusions

The study aimed to explore the impact of utilising a co-design process to generate proposals for reducing single occupancy car travel to and from a university campus. The study was designed as an empirical comparison, rather than a case study, which is more commonly seen in the literature. Consequently, the use of co-design was deliberately limited to the application of selected methods and the creative involvement of the researchers was curtailed. This did however enable the study to focus on the collective impact of the creative methods employed.

Significantly more ideas per participant were generated by those in the co-design group than by the individuals taking part in a more traditional email-based consultative process. However, there was no difference in the innovativeness of the ideas created by each group – i.e. an idea created by the co-design group was no more likely to be innovative than an idea created by the email group. The higher number of innovative ideas generated by the co-design group resulted from the greater number of ideas per se generated by this group (and not a higher rate of innovation). Co-design activities are therefore of benefit where innovation is sought, by means of encouraging idea generation, a proportion of which are likely to be innovative.

Innovation is typically defined in relation to the specific context of use, and this study showed that there were considerable differences in the degree of innovativeness of the ideas generated, depending on whether an overall global, or local, application domain specific, perspective was taken. The participative processes employed in this study offered real potential for innovation within the locally defined application context (sustainable transport). These differences in rates of global and local innovativeness suggest that in addition, there is considerable benefit to be had in undertaking a detailed review of relevant innovation at a global level, and then looking to apply those ideas within the specific local context.

Note

1. Note that this and following tests were done without applying Yates's correction for continuity.

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Funding

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