Researcher Manual

Discrete Choice Experiment Tool

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Content

1. Background of the method

1.1 Introduction

A DCE can be used to reveal preferences by presenting hypothetical scenarios (called alternatives), goods and services (Hauber et al., 2016; Mangham et al., 2009). The respondents choose between the two alternatives, in several sets of choices. Each alternative within each choice set has specific characteristics – attributes with specific attribute levels (Mangham et al., 2009). Choices of respondents are analysed to infer the value placed on each of these attribute levels (Mangham et al., 2009).

Stated preference experiments enable the researcher to overcome the difference between survey questions and the real world, as they mimic actual decision tasks (Alexander & Becker, 1978; Hainmueller et al., 2015; Louviere et al., 2000). Hainmueller et al. (2015) show in a comparative study that results from paired conjoint designs (such as the DCE) come close to the behavioural benchmark; i.e. subjects measured behaviour matches their actual behaviour. They suggest that stated preference experiments function best if the subject pool mirrors the population of interest and if the experimental design is crafted to motivate respondents to engage with the hypothetical choices in a serious manner (Hainmueller et al., 2015).

1.2 Utility theory

The DCE-method is theoretically founded in random utility theory (Manski, 1977) and relies on the assumption of utility maximisation and rationality (Hall et al., 2004; Hauber et al., 2016; Mangham et al., 2009). An advantage of DCEs compared to for instance surveys, which can also ask for preference ratings of various attributes, is that DCEs present a comparison instead of asking subjects to state their opinion of one item. According to Thurstone (1927), humans are a lot better at comparing two alternatives than evaluating them individually.

By making the choice for a specific alternative, the respondent shows which alternative yields the highest individual benefit, or utility, for them. The utility that is gained from an alternative is assumed to be dependent on the utility of the specific attributes and attribute levels within that alternative (Hauber et al., 2016; Lancaster, 1966). This is expressed in the following formula:

$$U_{iq} = V(\beta, X_i) + \varepsilon_{iq} \qquad (1)$$

In which U_{iq} is the utility of alternative i for individual q, V is a function defined by the attribute levels, X_i is a vector of attributes for alternative i with weight β and ε_{iq} is the unobserved variation and measurement errors.

Although there are many critics of expected utility theory (see for instance Małecka, (2020) for a discussion on this topic), the assumption that we make in this study – that participants of the study will choose the alternative that they prefer most – is one that all who research (consumer) preferences, and all researchers who base their data on questionnaires, must make. Indeed, plenty of research points out that humans are not necessarily rational decision-makers (Fehr & Gächter, 2000; Fehr & Gintis, 2007; Fischbacher et al., 2001; Van Klingeren, 2022).

1.3 Attributes and orthogonal array

A critical aspect of DCEs is the choice of relevant attributes and attribute levels. The alternatives that are presented in each choice set (set of alternatives out of which a respondent chooses their preferred option) are not randomly composed of attributes. The best possible design is a full factorial one, including all possible combinations of levels and alternatives. As a full factorial model this is unrealistic (these designs could include up to an infinity of combinations) an orthogonal array is created; a simplified version of the full factorial model with which we can still measure preferences for all attribute levels. This is a design of choice sets which is orthogonal, which means that the attributes are uncorrelated, and balanced, which means that each attribute level appears with similar frequency (Sagebiel et al., 2014). The design can be created through the R-package *Idefix* (Traets et al., 2020) which enables users to generate optimal designs for discrete choice experiments.

1.4 Further reading

For more information on Discrete Choice Experiments see the following (amongst others):

- Hauber, A. B., González, J. M., Groothuis-Oudshoorn, C. G. M., Prior, T., Marshall, D. A., Cunningham, C., IJzerman, M. J., & Bridges, J. F. P. (2016). Statistical Methods for the Analysis of Discrete Choice Experiments: A Report of the ISPOR Conjoint Analysis Good Research Practices Task Force. Value in Health, 19(4), 300–315. https://doi.org/10.1016/j.jval.2016.04.004
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2. The DCE tool for Collectieve Kracht

2.1 The intake

The first step in the process of creating and conducting a DCE with the Collectieve Kracht DCE tool is the intake. The intake is a Qualtrics survey that has to be filled out by one delegate from the citizen collective of interest (https://erasmusuniversity.eu.qualtrics.com/jfe/form/SV_3UxuyC9IwywzA8e). In the survey, the delegate provides some basic information, such as name of the collective, number of members and expected number of members that will participate in the study. A lower limit of 100 participants is set to retain enough statistical power for the later analyses. However, more is generally better, especially if the researcher wants to do more complex analyses than a basic conditional logit model to analyse the data.

It is important that the delegate of the citizen collective understands what a DCE can and cannot do, and that the DCE tool offered by Collectieve Kracht is a generic tool that can be tailored to a specific situation only to a certain extent. To provide explanation, an infographic was created:

In addition, the intake provides extra explanation of the DCE method, including various examples.

This explanation page can be found here:
https://erasmusuniversity.eu.qualtrics.com/jfe/form/SV_3IRTV1mDnZnwuMe

2.1.1 Choosing attributes

In the intake survey, delegates have to make certain choices. After being asked which type of citizen collective they represent, they are presented with a list of attributes. Some attributes are set – they are always incorporated in the DCE to allow for comparisons between different DCEs. Other attributes are optional. The delegate can choose the optional attributes, to create a DCE with up to 8 attributes with 2 or 3 levels. See the table below for a brief description of the set and optional attributes and attribute levels. Note that these are abbreviated descriptions; the actual attributes and attribute levels are more extended.

Citizen collective type	***Energy***	***Food***	***Care***	***Other***
Set attributes				
	Participation of members in decision-making process (possible / not possible)	Participation of members in decision-making process (possible / not possible)	Participation of members in decision-making process (possible / not possible)	Participation of members in decision-making process (possible / not possible)
	Voting rights (one member one vote / dependent on number of shares)	Voting rights (one member one vote / dependent on number of shares)	Voting rights (one member one vote / dependent on number of shares)	Voting rights (one member one vote / dependent on number of shares)
	Evolution and growth (focus on spread and growth / focus on small and local)	Evolution and growth (focus on spread and growth / focus on small and local)	Evolution and growth (focus on spread and growth / focus on small and local)	Evolution and growth (focus on spread and growth / focus on small and local)
	Percentage green energy (0% / 33% / 66% / 100%)	Weekly cost (0-10 euro / 10-30 euro / 30-50 euro)	Execution of care (by care professionals / care professionals and members / by members)	
	Price per kWh (20 cents / 25 cents / 30 cents / 35 cents)			
Optional attributes				
	Impact (company focus on societal impact and members / focus just on members)	Impact (company focus on societal impact and members / focus just on members)	Impact (company focus on societal impact and members / focus just on members)	Impact (company focus on societal impact and members / focus just on members)
	Profit (divide over members as dividend / invest in the organisation /	Profit (divide over members as dividend / invest in the organisation /	Profit (divide over members as dividend / invest in the organisation /	Profit (divide over members as dividend / invest in the organisation /

	invest in societal projects)	invest in societal projects)	invest in societal projects)	invest in societal projects)
	Number of members (limited / unlimited)	Number of members (limited / unlimited)	Number of members (limited / unlimited)	Number of members (limited / unlimited)
	Distance to headquarters of the collective (local / regional / supra-regional)	Distance to headquarters of the collective (local / regional / supra-regional)	Distance to headquarters of the collective (local / regional / supra-regional)	Distance to headquarters of the collective (local / regional / supra-regional)
	Transparency of price (complete transparency / only legally required transparency)	Transparency of price (complete transparency / only legally required transparency)	Transparency of price (complete transparency / only legally required transparency)	Transparency of price (complete transparency / only legally required transparency)
	Compulsory cost for membership next to electricity costs (yes / no)	Compulsory cost for membership next to electricity costs (yes / no)	Compulsory cost for membership next to electricity costs (yes / no)	Compulsory cost for membership next to electricity costs (yes / no)
	Number of social events next to General Assembly (none / monthly / yearly)	Number of social events next to General Assembly (none / monthly / yearly)	Number of social events next to General Assembly (none / monthly / yearly)	Number of social events next to General Assembly (none / monthly / yearly)
	Diversification of services next to electricity (none / some / a lot)	Food acquisition (delivery service or pick up / only pick up)	Target audience (elderly / disabled people / no specific target audience)	
	Energy delivery (through net provider / providing it themselves)	What happens when there is a shortage (buy external food / don't buy external food)	Conditions for receiving help (certain number of years membership / one-time payment for help / no specific conditions)	
	Possibility to receive advice from the organisation on installations and sustainability (generic advice / individual advice)	Uniformity of branches (all branches have the same organisational model / autonomy per branch)	Membership conditions (everybody can be a member / selective procedure to become a member)	
		Type of membership (producer / consumer / prosumer)		
		Food availability (all year round /		

		some months a year)		
		Maintenance (obligatory participation by members / voluntary participation by members)		
		Length food chain (short chain with local products / longer chain without necessarily local products)		
		Organic food (yes / no)		

2.1.2 Choosing survey questions

After choosing the attributes to be included in the DCE, the delegate filling in the intake has a choice of adding questions to the post-experimental survey. Similar to the DCE attributes, some questions from the survey are set, and some are optional to be chosen by the one filling in the intake. The table below lists the set and optional post-experimental survey topics per citizen collective type.

Citizen collective type	**Energy**	**Food**	**Care**	**Other**
Set questions	Age	Age	Age	Age
	Gender	Gender	Gender	Gender
	Combined net household income	Combined net household income	Combined net household income	Combined net household income
	Education	Education	Education	Education
	Year of becoming a member	Year of becoming a member	Year of becoming a member	Year of becoming a member
Optional questions				
	Living area type	Living area type	Living area type	Living area type
	House type	House type	House type	House type
	Municipality	Municipality	Municipality	Municipality
	Nr household members	Nr household members	Nr household members	Nr household members
	kWh use	How happy with membership	Receiving care at this point	How happy with membership
	Using electricity for cooking	How important is autonomy that comes with being a member of a citizen collective	How happy with membership	How important is autonomy that comes with being a member of a citizen collective
	Using electric car		How important is autonomy that comes with being a member of a citizen collective	
	Possessing (hybrid) heatpump			
	Solar panels			
	How happy with membership			
	How important is autonomy that comes with being a member of a citizen collective			

2.2 Creating the DCE survey

After the intake survey is completed, the researcher will have the data on the choices that were made. Using the R script provided, this data is used to create a survey file and orthogonal array in csv format. The two csv files representing the content of the DCE and the post-experimental survey are then used in the Python script provided to create a qsf file which can be uploaded to Qualtrics to reveal the DCE and post-experimental survey that resulted from the intake. The link to this survey can then be shared with the delegate of the citizen collective to spread amongst the members of the citizen collectives. To use the R and Python scripts properly, use the readme file in the repository.

2.3 Sending out the survey

The survey will have to be sent out to either all the members of the collective, or to a random sample of them in case the member base is too large. Make sure that there is indeed the possibility to send out the survey link to a random sample: if only a certain non-random sample of members fills in the survey this will have consequences for the usability of the data for scientific research. The invitation for members to participate can be included in a newsletter or be sent as a separate invitation. A reminder email may be necessary after a few weeks.

An example of an invitation for members could be:

> *"We nodigen onze leden uit om deel te nemen aan een wetenschappelijk onderzoek van de Erasmus Universiteit Rotterdam in samenwerking met [citizen collective name]. Via een eenvoudig keuzespel meten we de voorkeuren van leden van coöperaties zoals [citizen collective name].*
>
> *In het keuzespel moet u veertien keuzes maken, telkens tussen twee coöperaties met verschillende eigenschappen. Het duurt ongeveer 12 minuten en is volledig anoniem.*
>
> *De resultaten helpen de onderzoekers en [citizen collective name] om de motivatie en de voorkeuren van coöperanten te leren kennen en begrijpen. Zo kunnen we onze werking en ons beleid verbeteren en de burgerbeweging verder laten groeien.*
>
> *Als u de survey start en zich later bedenkt, kunt u uw tabblad gewoon sluiten. Onvolledige bevragingen worden niet verwerkt.*
>
> *Hartelijk dank voor uw deelname!"*

Make sure to share only the anonymous link to the delegates of the citizen collective – they cannot receive access to the Qualtrics project itself in order to preserve anonymity. By having the delegate(s) from the citizen collective send out the invitation to the members to participate, the researchers will not have access to any identifiable data from the participants. In turn, the delegates from the citizen collective do not have access to the data. However, as the survey provides a completion code, the participants can always ask their citizen collective to delete their data from the database by providing the completion code, which the delegates of the citizen collective can then send to the researchers who will remove the data from the database without knowing who requested the deletion.

3. Analysing the results

The deliverables from the DCE tool are twofold: a report for the cooperative discussing the most important findings from the DCE and post-experimental survey, and potentially a scientific paper on member motives from the specific citizen collective(s).

3.1 The report for the cooperative

Once enough data is gathered – that is, at least 100 respondents but ideally up to 1000 respondents have filled in the DCE survey – the data can be downloaded from Qualtrics. Using the RMarkdown script provided in the repository, the data will be turned into a simple report, reporting descriptive statistics on the participants of the study and a basic conditional logit model analysis of the DCE part of the study. If the study was done with an energy cooperative, a willingness to pay analysis is provided as well.

The researcher should add the date and name of the cooperative in question, and if they wish they can add other information too. This report can then be shared with the delegates of the citizen collective, who may want to share it further with their members. The report can also be summarized into a news article for Collectieve Kracht.

3.2 Further analysis

If the researcher wishes to do a more elaborate study using the data, there are several options for further analysis – expertly described in Hauber et al. (2016).

Summarized, the options are the following:

- Conditional Logit Model (including interaction effects if necessary)
- Random-parameters logit
- Hierarchical Bayes
- Latent-Class Finite-Mixture Model (to create preference classes)
- Willingness to Pay analysis

See also Sagebiel et al. (2014) for a good example of the analysis of DCE data, or find other papers that use DCE data to get inspiration.

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