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Collecting large personal networks in a representative sample of Dutch women

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ABSTRACT

In this study we report on our experiences with collecting large personal network data (25 alters) from a representative sample of Dutch women. We made use of GENSI, a recently developed tool for network data collection using interactive visual elements that has been shown to reduce respondent burden. A sample of 758 women between the ages of 18 and 40 were recruited through the LISS-panel; a longitudinal online survey of Dutch people. Respondents were asked to name exactly 25 alters, answer sixteen questions about these alters (name interpreter questions), and assess all 300 alter-alter relations. Nearly all (97%) respondents reported on 25 alters. Non-response was minimal: 92% of respondents had no missing values, and an additional 5% had fewer than 10% missing values. Listing 25 alters took 3.5 ± 2.2 (mean $\pm$ SD) minutes, and reporting on the ties between these alters took 3.6 ± 1.3 min. Answering all alter questions took longest with a time of 15.2 ± 5.3 min. The majority of respondents thought the questions were clear and easy to answer, and most enjoyed filling in the survey. Collecting large personal networks can mean a significant burden to respondents, but through the use of visual elements in the survey, it is clear that it can be done within reasonable time, with enjoyment and without much non-response.

1. Introduction

Collecting personal network data is not an easy task. An important decision researchers have to make involves choosing the number of people (or alters) to ask for that are in some way related to the respondent. This decision will have a great impact on the time and effort for respondents to fill in the survey, because listing many alters typically also means having to answer questions about each of these alters. Moreover, when researchers are interested in relationships within the personal networks, it means assessing many alter-alter ties. Here we describe the results of a study in which we asked for large personal networks (i.e., 25 alters[1]) among a representative sample of Dutch women. To collect our data we made use of GENSI, a recent tool that uses visualisations and interactive designs to collect personal networks online. Respondents had to answer many alter questions and assess all 300 alter-ties. Here we describe our design choices and the results of our study in terms of the duration of the different elements of the survey, non-response, data quality, and enjoyment.

Researchers interested in personal networks face a trade-off when asking for a set number of alters (Golinelli et al., 2010). On the one hand, choosing a low number of alters (e.g., <5) for respondents to list may come at a cost of leaving out important alters and it will almost certainly mean that "weak ties" are not included in the personal network (Granovetter, 1973). It further means that structural characteristics of the network can be unreliable (Golinelli et al., 2010; McCarty et al., 2007a). On the other hand, choosing a high number of alters leads to different sets of problems, particularly in terms of the burden on respondents. First, listing many alters takes time. Second, the time needed to respond to all questions on alter characteristics (or: name interpreter questions) increases linearly with each respondent. Third, in case researchers are interested in the ties between alters, the number of assessments that people have to make rises steeply with each additional alter (McCarty and Govindaramanujam, 2005; McCarty et al., 2007b). The time burden and the repetitiveness of the questions and the anticipation thereof can lead to decreased motivation and drop-out, and increased non-response compromising the quality of the personal network data (Hogan et al., 2007; Hsieh, 2015; Manfreda et al., 2004; Matzat and Snijders, 2010; Tubaro et al., 2014). Network studies might thus be prone to satisficing

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[1] Whether 25 can be considered large is of course dubious. It is rather small when seen in the light of the entire network an individual might have that can contain hundreds or thousands of members (de Sola Pool and Kochen, 1978; Killworth et al., 1990). It is rather large seen in light of previous research on personal networks, particularly in representative samples.

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(Krosnick, 1991; Stark and Krosnick, 2017): when respondents use strategies to reduce effort on and expedite on answering survey questions rather than giving the optimal answer. In its most extreme form, respondents arbitrarily select their answers (Krosnick, 1999) and engage in "mechanical clicking" (Matzat and Snijders, 2010), repeatedly selecting the same answers to go through the questions more rapidly.

One way to alleviate these issues, is to improve the user experience when filling in a survey. Designing network surveys that minimise the time and effort and increase the engagement for respondents will improve data quality, particularly when researchers are interested in large(r) personal networks (e.g., >10 alters) (Manfreda et al., 2004). The use of a more interactive and visually responsive survey might be one way to do this. Indeed, there is evidence to suggest that the use of graphic displays when collecting network data can increase data quality (Coromina and Coenders, 2006; Stark and Krosnick, 2017) and enjoyment of doing the survey (Hogan et al., 2007; Stark and Krosnick, 2017; Eddens et al., 2017), and reduce cognitive burden (Manfreda et al., 2004; Tubaro et al., 2014). This seems to hold across qualitative (Jaspersen and Stein, 2019; Ryan and D'Angelo, 2018; Tubaro et al., 2016) and quantitative (McCarty et al., 2007b) network studies and in both face-to-face interviews (Hogan et al., 2007) and online (or computer-assisted) surveys (Coromina and Coenders, 2006; Stark and Krosnick, 2017; Eddens et al., 2017).

The use of visualisation may be particularly useful for online surveys (Coromina and Coenders, 2006; Matzat and Snijders, 2010) when there is no interviewer present that can help filling in the survey, reduce satisficing, question non-response, and motivate respondents when motivation is fading (Perry et al., 2018). Clever and engaging visual survey designs may (partly) fill these roles. Indeed, the complexity of personal networks survey itself render them ideally suited for online (or computer-assisted self--interviewing) studies (Gerich and Lehner, 2006). Yet online studies should be carefully designed (Kogovšek, 2006; Manfreda et al., 2004; Matzat and Snijders, 2010; Pustejovsky and Spillane, 2009; Vehovar et al., 2008). Previous research has for instance shown that the number of boxes on the screen when asking for alter names determines how many alters are listed (Manfreda et al., 2004; Vehovar et al., 2008). Also, asking questions per-topic (i.e., ask a particular question about all alters) leads to improved survey outcomes compared to asking questions per-alter (i.e., ask all questions per alter) (Coromina and Coenders, 2006; Vehovar et al., 2008).

Stark and Krosnick (2017) took these ideas to heart and developed GENSI (Graphical Ego-centered Network Survey Interface).[2] GENSI is an online survey tool that goes beyond standard survey questionnaire designs, by making use of visualisations of nodes and networks that aid respondents in questions about alters and alter-ties. In an experimental design these authors showed, in line with the above mentioned research, that people who used GENSI to do the survey rather than a standard design: enjoyed the survey more, thought the survey was more interesting, and said they were more willing to participate in a future survey. There was some evidence that GENSI reduced "mechanical clicking" (respondents' repeated selection of the same answers to go through the questions more rapidly). The benefits of GENSI compared to the standard survey design could not be explained by duration of survey, as GENSI did not seem to speed up the process of filling in all questions.

1.1. GENSI for large personal networks

As Stark and Krosnick noted in their study, a limitation of the tool is that it is only suitable for small personal networks (<8) because introducing more nodes on the screen might clutter the screen making answering questions more difficult. This is particularly true when respondents have to draw links between alters to signify alter-alter ties. Indeed, previous studies suggest the "hairball" of lines that is created by adding lines between alters creates difficulties for respondents (Eddens and Fagan, 2018; Lippe and Gamper, 2017). We have further developed GENSI such that it allows data collection on 25 alters (the choice for 25 alters is discussed below). In many ways, the new design is similar to the original, except for how the 25 alters, represented as circles, are distributed across the screen. Respondents were asked to list exactly 25 names through a name generator question, and the 25 circles on screen filled up with each additional name (Fig. 1a).

Name interpreter questions were presented subsequently in such a way that one question was asked about all alters simultaneously, before moving on to the next question (Coromina and Coenders, 2006; Vehovar et al., 2008). There were three types of name interpreter questions that followed. The first type was one with two possible outcomes (e.g., male or female); all 25 circles were laid out across the screen and respondents had to click on those circles (names) that had particular traits (e.g., were male; Fig. 1b). Circles clicked on changed colour and moved to a more prominent position on the screen. A second type of question was one with five option categories (e.g., education, closeness; Fig. 1d). The five options were presented as boxes below the screen, and respondents had to drag the circles to the boxes below. To indicate to the respondent that the circle was in the box, it would change colour. The choice for five options were two-fold. First, having five options has been shown to work well for personal network questionnaires (Ferligoj and Hlebec, 1999). Second, having more than five options would reduce the boxes in size, therefore making the boxes less visible and more difficult to drag circles into. The third type of question was one in which there were many option categories. Either as radiobuttons (in case of age), or as checkboxes (in case of the type of relationship; Fig. 1c).

The design when asking for alter-alter ties was different from the version of GENSI from Stark and Krosnick (2017). The first listed alter was placed in the middle of the screen, with the remaining 24 alters as circles around this alter (Fig. 1e). Respondents could then click on each circle/name who knew the alter in the middle, and a line would appear that visualises the connection. When the respondent was done with reporting all ties to the alter in the middle, the second listed alter would move to the middle, while the circle of the first alter would be removed from the screen (this means that alter-alter-ties are considered bidirectional). The respondent could then again click on each circle/name who knew the alter in the middle. While this process continued, the circle of alters grew smaller with each step (Fig. 1f). This method thus retains elements that enjoyed highest respondent satisfaction in a randomised comparison of seven ways to gather alter-tie data (Eddens and Fagan, 2018), yet avoids cluttering of lines on screen that hamper adding new connections (Eddens and Fagan, 2018; Lippe and Gamper, 2017).

1.2. This study

The aim of the study is to get an overview of the feasibility of collecting large personal networks in an online study using a representative sample. For different elements of the surveys (e.g., listing alters, responding to alter questions, and assessing alter-alter ties), we take a detailed look at how long respondents need to perform these elements. Moreover, for each question we examine non-response, and we assess alter-tie data quality. Finally, we examine how much people enjoyed filling in the survey and whether they understood the questions. Results of this study can help researchers in planning their personal network studies.

2. Methods

2.1. Participants

In this paper we make use of data of the LISS (Longitudinal Internet

[2] There are many excellent alternative programs that make use of visualisations to facilitate personal network data collection in on- and offline settings, including EgoNet/EgoWeb (McCarty and Govindaramanujam, 2005), VennMaker (Gamper et al., 2012), NetworkCanvas (Hogan et al., 2019; Network Canvas, 2016), OpenEddi (Eddens et al., 2017), and GENSI-spinoff GENTLE (Krause and Jeronimus, 2019).

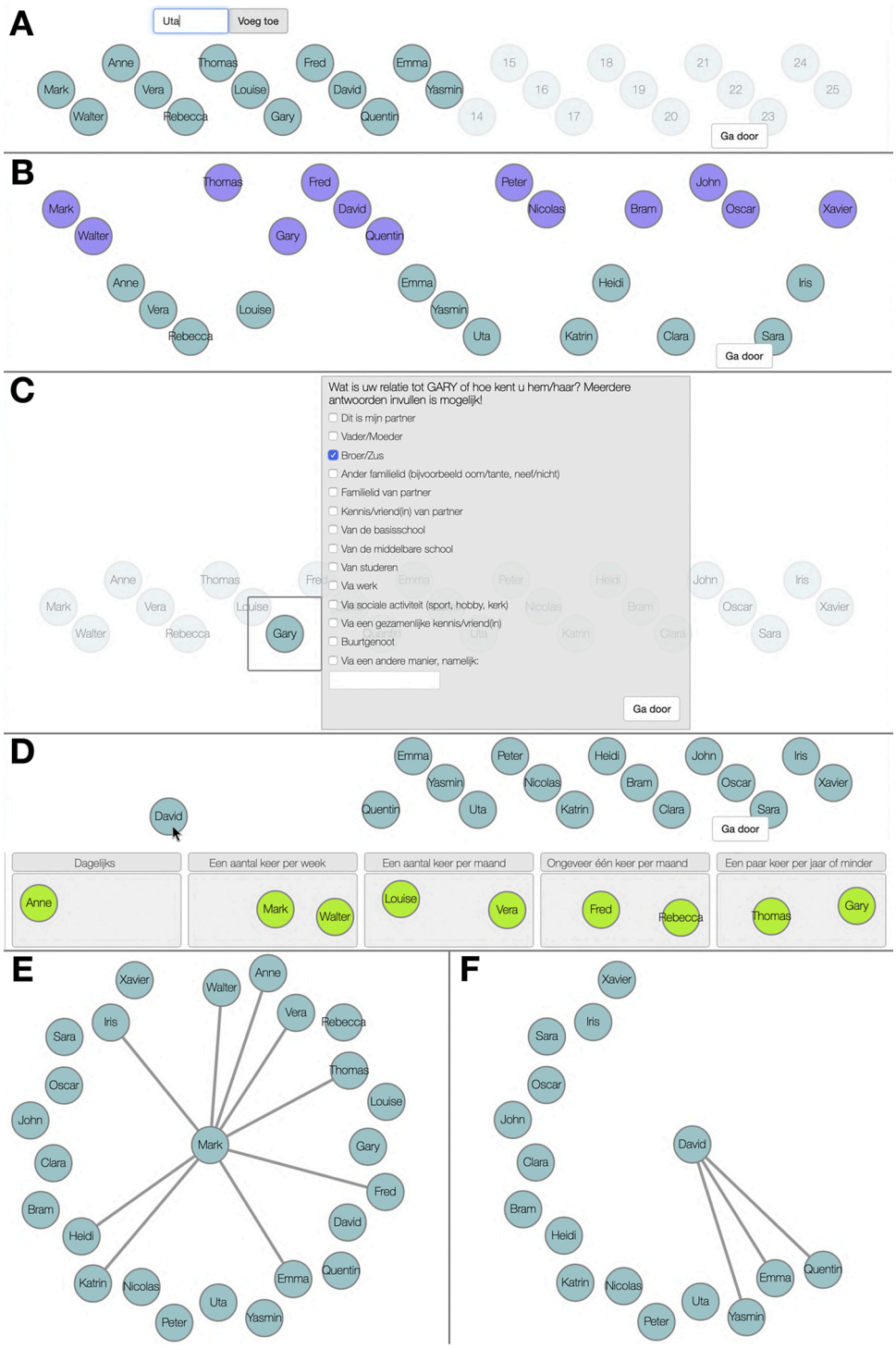

Fig. 1. Overview of GENSI. (For interpretation of the references to colour in the text, the reader is referred to the web version of this article.)

Studies for the Social sciences) panel administered by CentERdata (Tilburg University, The Netherlands). The LISS panel is a representative sample of Dutch individuals who participate in monthly Internet surveys. The panel is based on a true probability sample of households drawn from the population register by Statistics Netherlands (CBS). Households that could not otherwise participate are provided with a computer and Internet connection. Only households in which at least one household member spoke Dutch are included. A longitudinal study consisting of 10 core surveys are fielded in the panel every year, covering a large variety of domains including work, education, income, housing, time use, political views, values and personality. The respondents were thus part of a longitudinal panel and had plenty of experience with filling in online surveys alleviating some of the worries of surveying via the web about respondent motivation, satisficing, and non-response.

Much effort was put into ensuing a representative sample and high response rates. The resulting representativeness of the LISS-panel was similar to those from traditional surveys based on probability sampling (Knoef and de Vos, 2009; Scherpenzeel and Bethlehem, 2011). Initial selection biases were substantially corrected by refreshment samples, and further refreshment samples were planned for attrition biases (Scherpenzeel, 2011). The LISS-panel has information on over 10,000

individuals.

2.2. Social networks and fertility survey

The LISS-panel allows researchers to do their own survey within the panel. We added a study named the *Social networks and fertility* survey (in Dutch: Sociale relaties en kinderkeuzes onderzoek). This research involves investigating social influences on fertility desires and outcomes (i.e., how many children people have or would like to have). For this survey all women in the LISS panel between the ages of 18 and 40 ($N = 1332$) were invited to participate between February 20 and March 27, 2018. In total, 758 women completed the survey with a mean age of 29.2 (SD = 6.5). Out of the 574 cases of non-response, 66 women had clicked on the survey link but did not complete the survey; we could not verify whether these respondents had not started the survey or whether they dropped out. A further 7 respondents gave a reason for their non-response (e.g., no time, on vacation). The remaining 501 respondents did not respond in any way to the invitation for the survey. Respondents were very similar to non-respondents based on a comparison of a range of measures that are collected for all respondents and are continuously updated, including birth year, position in household, number of children, marital status, region of living, income, educational level, and (migration) background. Largest but still small differences were observed in highest educational level with a degree and background. Among respondents, 22% had a master's degree and 23% had completed vocational training, compared to respectively 18% and 28% in non-respondents. With respect to (migration) background: 68% of respondents were native Dutch compared to 63% of non-respondents. See the supplementary materials for further details.

Ethical approval for this particular study was obtained through the ethical committee of sociology at the University of Groningen (ECS-170920). For information on the ethical approval on the LISS-panel as a whole, see www.lissdata.nl/faq-page#n5512. The survey was in Dutch. For the full survey in Dutch, an English translation of the questionnaire, further description of the survey, an example of the working of GENSI, the code to produce the GENSI-questionnaire, and code to clean and correct the LISS survey data, please visit: https://hdl.handle.net/10411/WW7GZP. R-code to produce the current manuscript, can be found here: https://hdl.handle.net/10411/N2TIVF. Data will become available in August, 2020 on https://www.lissdata.nl.

2.3. Procedure

Respondents were invited to participate on a study on "social networks and fertility" and instructed that the survey would probably take around 25–30 min and that they would be compensated for their time. Respondents received €12.50 for completing the survey, which is ∼5 euro more than the standard rate of LISS of ∼ €2.50 per 10 min. Respondents were instructed to do the survey on their computer, because GENSI currently does not scale well to smaller screens.

The first block of questions concerned questions about the fertility intentions and desires of the respondents and their partners if they had one. The second part of the questionnaire involved generating 25 names (Fig. 1a). Respondents were asked: "Please list 25 names of individuals 18 years or older with whom you have had contact in the last year. This can be face-to-face contact, but also contact via phone, internet, or email. You know these people and these people also know you by your name or face (think of friends, family, acquaintances, etc.). You could reach out to these people if you would have to. Please name your partner in case you have one. The names do not have to match perfectly; you can also use nicknames. It is important that you would recognise these names in a future survey. For this research it is important that you actually name 25 individuals!". This phrasing was based on the studies by McCarty and colleagues (McCarty et al., 2007a,b). If a respondent continued the survey without listing 25 names, a pop-up screen appeared stating that for this survey, listing 25 alters was important, and that if they had difficulties coming up with names, they could use a contact list. They were also informed that if they still wanted to continue without listing 25 names, that this was also possible. We chose 25 alters because: (1) people can easily do so (McCarty, 2002; McCarty and Govindaramanujam, 2005); (2) this number is sufficiently large that the network would likely also consist of weak(er) ties; and (3) because a lower numbers of alters compromises the reliability of particular estimates of the structure of the network (Golinelli et al., 2010; McCarty et al., 2007a). The choice to ask respondents to list 25 and not fewer (or more) was deliberate: leaving the number of alters to choose up to the respondent might mean that the variation in number of alters is due to variation in motivation or due to different interpretations of the questions. Some respondents will find listing 25 alters easy, other might find it hard, but this is exactly the variation that network researchers are interested in and this will be reflected in the alter characteristics (McCarty et al., 2019).

Subsequently, 16 alter characteristics were asked about in the following order:

gender: male or female (click on circle; Fig. 1b).

age: 18, 19, …, 49, 50, 50+ (radiobuttons).

type of relationship: partner, parent, siblings, other relative, relative of partner, acquaintance/friend of partner, from primary school, from high school, from college/university, from work, from a social activity, through a mutual acquaintance/friend, from the neighbourhood, and other (checkboxes, multiple answers possible; Fig. 1c).

closeness: very close, close, somewhat close, not close, really not close (drag to boxes; Fig. 1d).

education: Primary school or has not finished primary school, High-school diploma (or a similar diploma), Secondary vocational education (or a similar diploma), Higher vocational education (or a similar diploma), University degree or higher (or a similar diploma) (drag to boxes; Fig. 1d).

frequency of face-to-face contact: Daily, A couple of times per week, A couple of times per month, About once a month, A couple of times per month or less (drag to boxes; Fig. 1d).

frequency of other forms of contact: Daily, A couple of times per week, A couple of times per month, About once a month, A couple of times per month or less (drag to boxes; Fig. 1d).

which of these people do you consider a friend: friend or not friend (click on circle; Fig. 1b).

does alter have children: yes or no (click on circle; Fig. 1b).

how many children does alter have: expecting first child, 1, 2, 3, 4, 5, >5, I do not know (radiobuttons). This question was only asked about alters that have children.

how old is the youngest child: expecting first child, Between 0 and 6 months, Between 6 and 12 months, Between 1 and 2 years, Between 2 and 3 years, Between 3 and 4 years, Between 4 and 5 years, Older than 5 years, I do not know (radiobuttons). This question was only asked about alters that have children.

how do you think the happiness of alter changed after the birth of their children: Happiness of alter has increased after the birth of the child(ren), Happiness of alter has stayed the same after the birth of the child(ren), Happiness of alter has decreased after the birth of the child(ren), I do not know, The child of alter has not been born yet (radiobuttons). This question was only asked about alters that have children.

from which individuals do you know that they would like to have children: would like to have children or do not know whether individual wants children or not (click on circle; Fig. 1b). This question was only asked about alters that did not have children.

from which individuals do you know that they would not like to have children: would not like to have children or do not know whether individual do not wants children or not (click on circle; Fig. 1b). This question was only asked about alters that did not have children and that did not want to have children.

which of these individuals could you ask for help with the care of the child: could ask for help or could not ask for help (click on circle; Fig. 1b).

with whom of these individuals do you discuss having children: discuss

having children with this individual or do not discuss having children with this individual (click on circle; Fig. 1b).

For all questions except the question about education, non-response probes were used when respondents did not click on any alter or when not all alters were dragged to boxes and respondents were asked to answer the question completely. Such non-response probes are recommended in personal network studies, as previous research suggest that accidental or intentional item nonresponse is likely to occur (Matzat and Snijders, 2010; Vehovar et al., 2008). In case a name interpreter question only applied to certain alters depending on answers to previous questions (e.g., "how many children does alter have?" was asked only about alters that had children as indicated in the previous question), the question would only hover over the alters that the question applied to. All names and circles were visible, but alters to which the question did not apply were shaded differently (made see-through). For the name interpreter questions on age, education, and the number and age of alter's children, respondents were asked to give their best guess when they did not know exactly.

The final question about the alters concerned the alter-alter ties (Fig. 1e). The following question was asked: "With whom does alter have contact? With contact we mean all forms of contact, including face-to-face contact, contact via (mobile) phone, letters, emails, texts, and other forms of online and offline communication. Select the individuals that have contact with one another by clicking on the circle. A line will appear that indicates that those individuals have contact with each other. Press the circle again to remove the line, if the individuals do not have contact with one another."

The survey ended with some additional questions about fertility, and one question about how they retrieved the 25 alter names (from memory or using email, Facebook, mobile phone, or some other form of contact list). For the specific wording of each question, see the codebook in the supplementary materials.

2.4. Data analysis

We used R (R Core Team, 2018) for cleaning, transforming, analysing, and visualising all data and to write the manuscript. We made use of the following R-packages: knitr (Xie, 2018), patchwork (Pedersen, 2017), ggeconodist (Rudis, 2019), rticles (Allaire et al., 2020), and the tidyverse (Wickham, 2017). This study is descriptive. We will focus on the magnitudes of the effects on the original scales, and we will not incorporate any inferential statistics or *p*-values. We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study.

3. Results

3.1. How many alters were listed?

Respondents were asked to name exactly 25 alters. From the 758 respondents, 745 named exactly 25 alters, 12 named exactly 24, and 12 (1.6%) women listed fewer than 15 names.

One respondent mentioned in the comments that she did not know 25 individuals, or at least was not able to communicate with them if she had to. Another respondent gave problematic characterisations of the relationship ties (rather than, e.g., "mother", or "partner", the description was sometimes missing or not a name (e.g., "hoi" meaning "hi", and "don't know"). There were 5 respondents that indicated that they had listed the same alter twice. Thus, there were 738 respondents that listed exactly 25 different alters.

3.2. Examining non-response on alter-questions

We subsequently verified to what extent non-response occurred on the alter questions, only examining respondents that listed exactly 25 alters. We only examined the questions in which respondents had to perform an action for all 25 alters either by selecting a response out of a list (age), selecting possible multiple options (relationship), or by dragging circles into boxes (closeness, education, face-to-face contact, other forms of contact). These questions (that equate to $6 * 25 = 300$ answers) should, in principle, contain no non-response, and any missing answer implied that respondents actively continued with the survey after a non-response probe. Most (92%) of respondents ($N = 682$) did not have any missing values. A further 5% of respondents had fewer than 10 missing values on all alter questions. Fig. 2 shows a breakdown of non-response per question.

Only one missing value was observed on the first two questions on the age and relationship to the alter. The question about the education of the alters increased non-response. There were 11 respondents that skipped the education question entirely, and from those respondents that did answer the question there were 70 respondents that at least had one missing. There are probably two reasons why education has more non-response than the first two questions: (1) they had to drag each circle into a corresponding box, which requires some effort; (2) the respondents might not know the education of all alters and the instructions were such that they could skip the question (in contrast to, for example, age, in which case respondents were asked to give their best guess). Non-response decreased after the question about education, although an additional four respondents entirely skipped the question about closeness. There was little non-response on the question about face-to-face contact frequency, yet two additional respondents skipped the questions about the frequency of other forms of contact. Maybe the similarity of the two contact questions were frustrating to respondents.

We also examined (non-)response on the alter-alter tie questions. Six respondents reported no ties between the 25 alters. While in principle it could be true that none of the alters know one another, this is more likely to indicate satisficing (this is further discussed in the section on assessing data quality).

3.3. Duration of responding to alter questions

Here we focus on the time it took respondents to respond to all questions relating to the personal network, including the name generator question, the name generator questions, and the questions on alter-ties. To be better able to compare the estimates, we only select respondents who had listed 25 alters, who had fewer than 10 missing values on all alter questions, and we excluded those that did the survey on a phone or tablet and those that listed no alter ties, leaving 706 respondents.

Half of respondents finished the questions within 22 min, with an average time of completion of 33 min (SD = 93). The minimum time to do the social network part of the survey was 8, and the maximum time 1540 min (>25.7 h). It is clear from the long durations to complete the survey that some respondents took breaks while doing the survey. To get a better grasp on the timing of the different elements of the survey, we focus only on respondents that seemed to have started and finished the survey in one run. We cannot be sure of this, but sudden 'bumps' in duration are likely to reflect a moment of pause (e.g., if a respondent uses 15 min to answer whether she has a partner, she probably used some of this time to do something else than filling in the survey). For the remainder, we only examine the 646 individuals that took less than 10 min on all single questions (excluding 60 respondents).

3.3.1. Listing 25 alters

On average respondents needed 3.5 min (SD = 2.2) to list 25 alters. Half of the respondents managed to list 25 alters within 182 s (~3 min), 75% of respondents were able to do this within 251 s (~4.2 min), and 95% of respondents within 426 s (~7.1 min), with a maximum time of 26 min. The average time it took to list alters two to five was less than 5 s (with SDs also ~5 s). It took more than twice as much time to list the last 5 alters, although this still took only about 10 s (with SDs >15; see Fig. 3b).

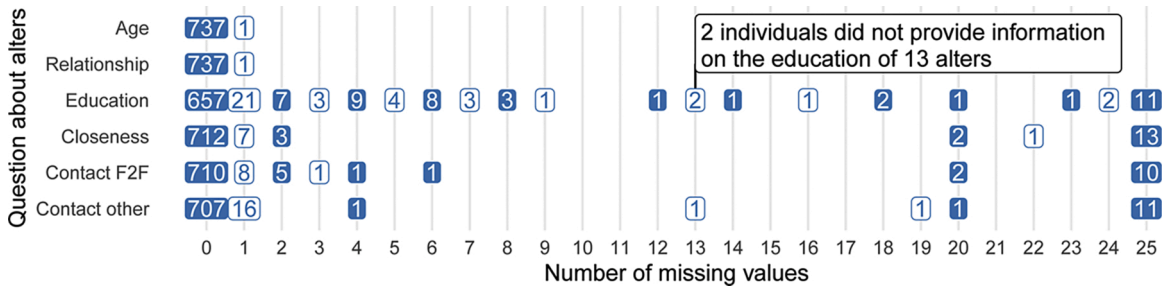

Fig. 2. Non-response on name interpreter questions that required a response for each alter.

3.3.2. *Different types of alter-questions*

The type of alter question had a strong effect on how long it took respondents to fill in the survey. Binary questions, where respondents had to click on alters if they contained a particular trait (e.g., was a man, was a friend, can help with child care) were fast, with the majority of respondents being able to complete these questions within 30 s (Fig. 3c). Questions where the respondents had to drag all circles into one of five boxes took longer, yet most respondents were able to complete these questions within 1.5 min. Addressing the questions of the age of the alters and the relationship with the alters (e.g., parent, partner) took longest, with a median time of completion of respectively 1.8 and 2.2 min.

Half of the respondents were able to respond to all alter questions within 14.3 min (mean ± sd: 15.2 ± 5.3; Fig. 3d), with 75% of the respondents being able to answer these questions between within 17.5 min, and 95% within 24.5 min, with a maximum time of 41.1 min.

3.3.3. *Alter-alter ties*

The final question about alter-alter ties meant that respondent had to provide links between all alters, meaning they had to make 300 assessments. Responding to all these alter-alter-tie questions took a median time of 3.4 min (mean ± sd: 3.6 ± 1.3; Fig. 3c), with 75% of the respondents being able to answer these questions within 4.3 min, 95% within 6.2 min, with a maximum time of 9.9 min.

3.3.4. *Were names generated from memory?*

While completing the survey, respondents were asked about how they retrieved the 25 alter names (from memory or using email, Facebook, mobile phone, or some other form of contact list). The majority of respondents ($N = 632$; 90%) listed the names from memory. A further 64 used their phone, 8 used Facebook, and 2 used their email to aid in listing alters. Respondents that listed the names from memory were quicker in doing so with a median of 3 min (mean ± sd: 3.4 ± 1.9) than respondents who used their phones as well (median: 4; mean ± sd: 5.1 ± 3.8). This is likely because respondents who had difficulties with

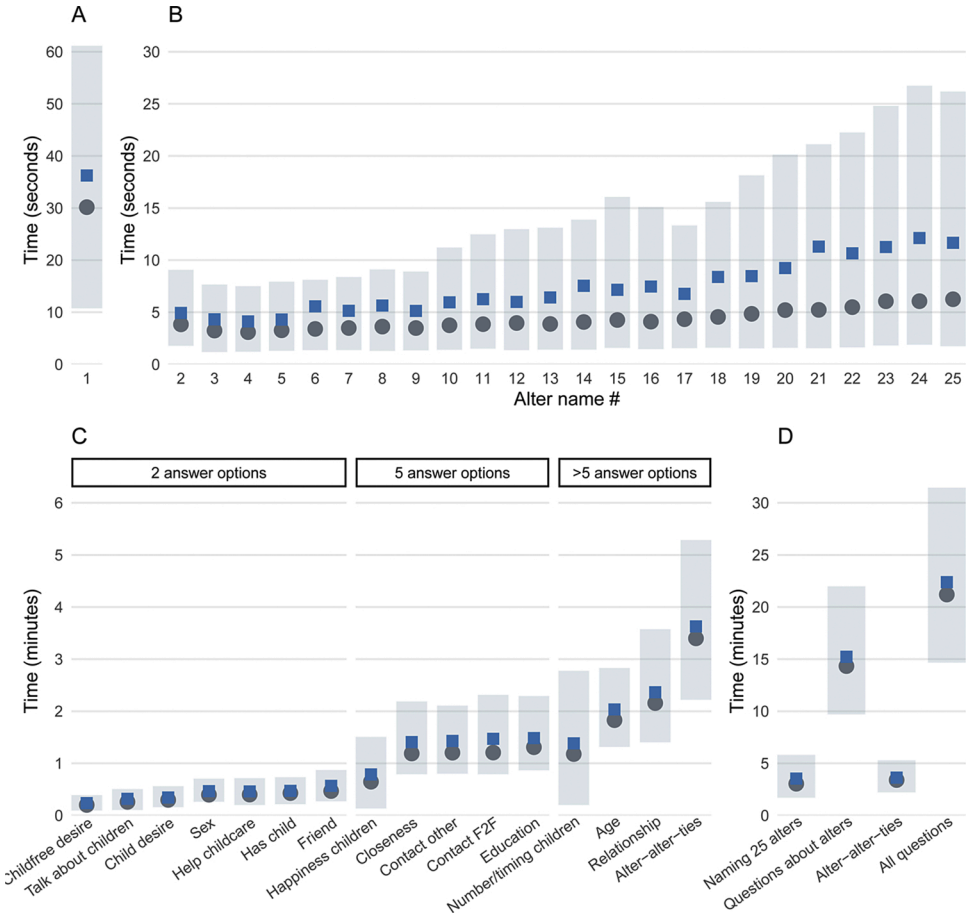

Fig. 3. Distributions of the time it took for the respondents to complete the questions on (A) naming the first alter (which included reading the name generator question); (B) listing the subsequent 24 alters; (C) responding to all alter questions (ordered on median duration, and seperated into questions that have either 2, 5, or more than 5 response options); (D) responding to different components of the survey. The lower bound of the shaded region corresponds to the 10th percentile, the upper bound to the 90th percentile, and the black circle to the 50th percentile (median). The blue square is the average. Scales vary per panel. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

generating names, are more likely to use some help.

3.4. Assessing data quality

The finding that respondents are able to list 25 alters and answer many name interpreter questions within reasonable times and without substantial non-response does not mean that the data that are gathered are high-quality. Indeed, previous studies have shown that respondent satisficing and "mechanical clicking" can be an issue in network studies, particularly when assessing alter-alter ties (Matzat and Snijders, 2010; Stark and Krosnick, 2017). Also in this study satisficing is most likely when respondents engage with the alter-ties: clicking on "next" would not result in a pop-up reminder to complete the question, and by tapping "next" 24 times respondents would quickly be done with assessing all alter-ties (resulting in no ties between any of the alters). Indeed, there were 6 respondents that reported no alter-ties. Three of these cases also had problematic answers on other questions. For the remaining three, no peculiar responses were observed. This means that these three probably either engaged in 'mechanical clicking' or did not understand the question.

We further examined satisficing and data quality by looking at whether respondents reported ties that likely exist. First by examining the ties between ego's partner and the alters that ego listed that were known through ego's partner and second by examining the ties between close kin (parents and siblings). It is likely that ties exist between ego's partner and the alters that ego identified as knowing through her partner (e.g., family in-law, friends and colleagues of the partner), when ego is in contact with these alters. It is not certain, however: it could be that ego's partner is not in contact with all of its family and friends and colleagues that were listed. Among respondents that listed both a partner and family or friends of their partner ($N = 417$), we found that 76% had listed all ties between them, 6% reported no ties, and 19% did not list all ties. In total, 89% of all possible ties between the partner and alters known through the partner were reported as ties.

When examining ties between close kin, we found that 82% of respondents that listed both parents and siblings ($N = 678$) had listed all ties between them. No ties were reported by 1% respondents, and 16% did not list all ties. In total, 87% of all possible ties between close kin were reported as ties. There was a small and positive association (Spearman's rho = 0.3; $N = 391$) between the two measures of reporting ties, indicating that respondents who may have underreported ties between partner and alters known through partner were also a bit more likely to underreport ties between close kin. In summary, almost 90% of all ties that likely existed between alters were reported, the majority of respondents reported all ties where they likely exist, and only a minority of respondents reported no ties. This suggests that "mechanical clicking" was not a major issue, although there was also some evidence that respondents who underreported ties in one domain, also underreported in a different domain.

3.5. Respondent satisfaction

640 respondents filled in questions about the survey. Respondents overwhelmingly thought the questions were easy to answer and that the questions were clear (Fig. 4). When asked whether they enjoyed filling in the questions, about one third of the respondents answered with "definitely yes". Only 9% of respondents enjoyed the survey below the midpoint of the 5-point scale.

4. Discussion

Web-surveys are here to stay. They are fast to implement, cheap compared to other forms of surveys, and are less susceptible to socially desirable answers as there are no interviewers present to impress (McNeeley, 2012). Yet, web-surveys have their shortcomings: often samples obtained through the web are not representative for the

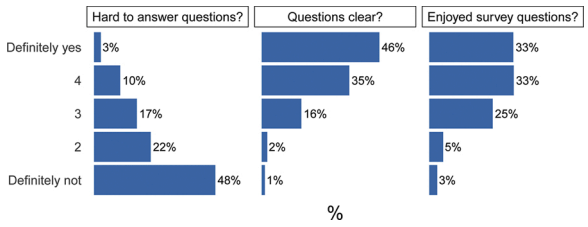

Fig. 4. Evaluations on the survey questions by the respondents ($N = 600$).

population at large, and data quality might suffer if there is no interviewer present to help and motivate the respondent. These problems are likely exacerbated in social network studies which are typically complex, time-consuming, and repetitive. We have tried to overcome these problems in this study. First, we made use of a representative online panel (Scherpenzeel and Bethlehem, 2011). Second, we have made use of interactive visual elements in the survey, based on personal network data collection tool GENSI (Stark and Krosnick, 2017) to make the survey more enjoyable and efficient. This was particularly needed because we collected personal networks of size 25, which is large for personal network studies in representative samples. In this study, we showed that collecting large personal networks online in a representative sample is feasible.

4.1. How long does it take to collect information on 25 alters?

Respondents were asked to report on exactly 25 alters (with whom they have had contact in the last year), and 97% was able to do so. Half of the respondents managed to list 25 alters in ~3 min, and 95% of respondents in ~7 min. Coming up with new names became progressively harder for the respondents, as listing the last five alters took twice as long as listing the first couple of alters (although still only about 10 s for coming up with the name and typing it in). For the majority of respondents names were listed from memory, and only one in ten respondents used some aid (e.g., mobile phone contact list, Facebook).

Ties between alters are rarely collected in large personal network studies because of the burden imposed on respondents in evaluating all relationships between all alters (McCarty, 2002). In this study, respondents had to evaluate 300 relationships. Perhaps through the visual design of the survey (Fig. 1e–f), respondents did not take very long to complete this part of the survey: half of respondents took ~3.5 min or less, and 95% within ~6 min. Naming 25 alters and evaluating the 300 relationships between these alters took equally long (~3.5 min on average).

Answering questions about alters took longest. Respondents were asked to report on 16 characteristics for each alter (including demographic characteristics and several measures of tie strength). This part took on average 15 min, which is substantial. Binary questions were fast (e.g., gender of alter, is alter a friend) and the majority of respondents were able to answer these questions within 30 s. Questions with five answer categories took about three times as long. The question on the relationship to the alter took longest, with an average time over 2 min.

In total, then, coming up with 25 names (alters), answering 16 questions about these alters, and assessing 300 relationships between alters, took on average 22 min, with half of the respondents being able to do so within 21 min.

4.2. Non-response, data quality, and respondent satisfaction

Non-response to questions is an issue in online studies, particularly when it comes to network data collection on the web. Despite the length of the survey, non-response on questions was minimal in this study. Most respondents (92%) had not a single missing value, and less than 3% had more than 10% missing values.

An additional sixty-six respondents had clicked on the invitation to participate in the survey, but did not complete the survey. Unfortunately, we were unable to verify whether these respondents simply had not started the survey or whether they had dropped-out after several questions. Thus, we were not able to measure drop-out. If we assume that all sixty-six respondents dropped out of the survey, this would imply an 8% drop-out rate which is still much less compared to other personal network studies (e.g., Vehovar et al., 2008).

Satisficing (Krosnick, 1991, 1999) and "mechanical clicking" (Matzat and Snijders, 2010; Stark and Krosnick, 2017) can also be an issue in network studies that compromises data quality, particularly when assessing alter-alter ties. When examining ties that are likely to exist (i.e., between the partner and the partners' relatives and friends, and between close kin), we found that almost 90% of ties were reported. The remaining 'missing' ties could be due to either (1) satisficing, (2) forgetting to report a tie, or (3) accurately reporting that the tie does not exist (e.g., divorced parents who are not in contact with one another). These results suggest that (the majority of) respondents gave accurate answers, even at the end of the survey during a repetitive task.

In line with the experimental results from Stark and Krosnick, respondents seemed to enjoy this study, with two out of three respondents indication they had enjoyed the survey questions, and only 9% saying they had not. Furthermore, respondents overwhelmingly thought that the questions were easy to answer and that they were clear. It must be noted that these questions about the survey are standard practice after each LISS-survey, and do not specifically focus on the GENSI-elements. This means that the results of this question cannot be used to support the statement that people enjoyed the design of the survey, because the enjoyment could be in relation to the content of the questions as well.

4.3. Limitations

There are several limitations to our study that hinder the generalisability of our results. First, although this study is rather unique in collecting large personal networks in a representative sample, it is a rather selective sample of only women between the ages of 18 and 40. The structure and composition of networks are different for men and women and for people of different ages, meaning that studies using the personal networks from this sample cannot be generalized to the population at large. Second, the low levels of non-response and the speed of answering survey-questions may similarly not hold true for other samples: respondents that participate in the LISS-study have substantial experience with filling in online surveys, get repeated reminders of the importance of their participation, and were paid rather substantially which may have increased motivation to seriously engage with the survey. For this study, respondents were paid €12.50 for completing the entire survey, which on average took about 30 min. Third, in contrast to the original GENSI-study, this study did not employ an experimental design comparing GENSI to standard survey approaches, meaning that we are not able to conclude that the current design improves respondent satisfaction and decreases respondent burden.

GENSI in its current form also has limitations. The current design was not suitable for small screens, which is problematic given that people increasingly do surveys on their mobile phone. Respondents were also not able to revise their earlier answers, which meant that errors could not be fixed by the respondents themselves and could only be reported at the end of the survey. Luckily, better alternatives exist that do not suffer from these problems. For example, a GENSI spin-off GENTLE (Graphical Ego-Network Tool for Longitudinal Examination; Krause and Jeronimus, 2019) was recently developed that is particularly suitable for longitudinal data collection on mobile phones. The same holds for OpenEddi (Eddens et al., 2017). Network Canvas (Network Canvas, 2016; Hogan et al., 2016) is further a great application that allows researchers to design their own personal network study.

4.4. Designing a personal network study

Many excellent resources exist on how to do conduct personal network studies (e.g., McCarty et al., 2019; Perry et al., 2018), including discussions on designing name generator questions, designing alter questions, and designing questions on alter-alter ties. Designing an online personal network study can further make use of research on the visual design of the different elements (e.g., this study; Eddens and Fagan, 2018; Stark and Krosnick, 2017). Assessing many alter-ties via the visual approach in this study (Fig. 1e–f) is an efficient option (see also Eddens and Fagan, 2018). This study can further contribute by providing a detailed picture on the timing of the different elements in personal network data collection. Researchers developing their own study can estimate, for instance, how long it would take to ask questions about 15 alters. They could similarly estimate costs in time from presenting a question with two options versus five or even more options. Decisions on the size of the personal network should further be based on studies on the robustness of structural network measures depending on network size (Golinelli et al., 2010; McCarty et al., 2007a). Future studies could help in addressing more formally the trade-off between respondent burden and data quality.

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