Social Networks 55 (2018) 130–141

Contents lists available at ScienceDirect

Social Networks

journal homepage: www.elsevier.com/locate/socnet

# Comparing nascent approaches for gathering alter-tie data for egocentric studies

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ARTICLE INFO

*Keywords:*
Egocentric
Data collection
Randomized trial
Interactive software
Survey methods
Alter ties

ABSTRACT

Egocentric network researchers have recently developed interactive, force-directed, node-link tools to alleviate the burden of collecting information about ties between alters. In this study we use a randomized trial with a common stimulus to compare the effectiveness, efficiency, and satisfaction of new tools to established tools. We find interactive node-link tools are very satisfying to users and produce accurate data, however it underreported ties, and results differed considerably between users. The results have implications for any research using an interactive node-link diagram or any of the established methods for alter-tie data collection in egocentric network studies.

## Introduction and background

Personal (egocentric) network surveys use many types of unique questions not found in typical psychometric surveys (Burt, 1984; Marsden, 2005). There are *name generator* questions to elicit a list of contacts, or alters, in the respondent's personal network. *Name interpreter* questions ask the respondent to describe each alter in different ways, such as reporting each alter's race, education, and age, or more nuanced questions, such as the respondent's opinion of the alter's political leanings. Perhaps the most difficult and time-consuming are questions which ask the respondent's perspective on the relationships *between* each pair of alters, such as whether each alter trusts, confides in, supports, or communicates with each other alter; these are the *alter-ties* (or *alter-alter-tie*) questions.

Due to the complexity and relative novelty of these types of surveys from the respondents' perspective, they are frequently conducted with the assistance of an interviewer. During the survey administration, it quickly becomes obvious to both the interviewer and the respondent that the more alters they provide, the more work they have ahead of them. For every additional alter named in an egocentric network survey, there are an additional $n$ - 1 directed alter-tie questions to answer. The number of alter-tie questions scales roughly with the square of the number of alters (see Fig. 1). For $n$ named alters there are $\frac{n(n-1)}{2}$ undirected alter-tie relations that need to be elicited from the respondent. Thus, if the respondent names just 10 alters and the interviewer is eliciting a single type of undirected alter-tie, there are a total of 45 questions. This curse of dimensionality adds an enormous burden to the interviewer and respondent. The interviewer or the respondent might take it upon themselves to artificially reduce the number of collected alters in an attempt to reduce the burden, which can affect the validity and reliability of egocentric network field research.

Until very recently, software has been of very little help with this problem. Many field researchers continue to use paper surveys to conduct this data collection task. Researchers have devised multiple paper-based tools for collecting the alter-tie data to make it easier, such as a matrix that is completed by the respondent, or illustrating each alter as a circle and asking the respondent to draw lines between those circles. While most psychometric survey research now employs online or digital surveys, the complexity and uniqueness of alter-tie questions have made the digital transition of egocentric network surveys difficult. In response many researchers and software developers have begun to offer new software which takes advantage of modern browser and tablet technology (e.g. OpenEddi (Fagan and Eddens, 2015), EgoNet (McCarty and Govindaramanujam, 2005), VennMaker (der Lippe et al., 2016), EgoWeb 2.0 (Kennedy et al., 2017), ANAMIA (Tubaro et al., 2014), netCanvas (Hogan et al., 2016), and GENSI (Stark and Krosnick, 2017/1). Though these tools are digital, most can be employed in an offline mode so as to facilitate data collection in settings where online access is limited. A common theme found in many of these software packages is a digital, interactive, force-directed node-link diagram where the alters are represented as nodes, or circles, and ties are drawn between them using a touch device or mouse. The force-directed aspect

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https://doi.org/10.1016/j.socnet.2018.05.009

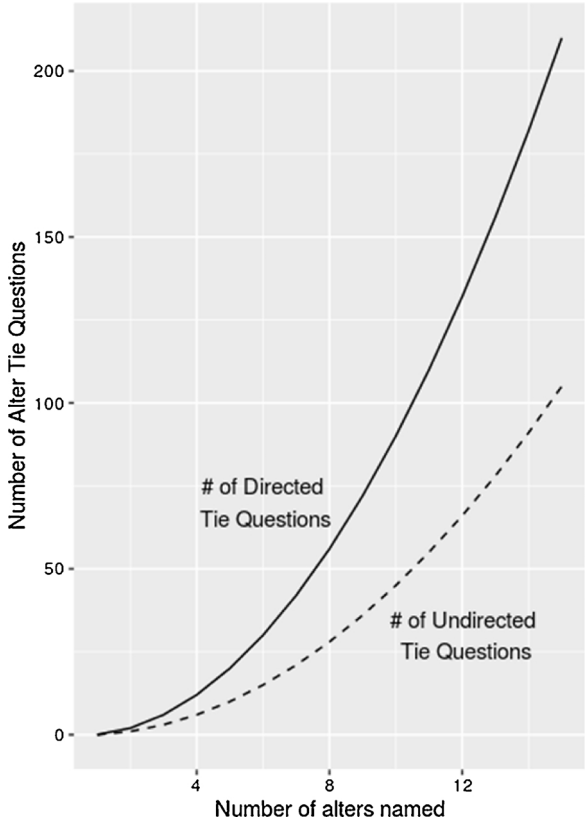


**Fig. 1.** Relationship of number of alters named to number of alter-tie questions.

is a real-time application of common graph drawing algorithms (Fruchterman and Reingold, 1991). The diagram shifts and moves organically in response to the user input and lays out the nodes in a way that simulates physical forces of repulsion and attraction. Users have found this type of tool easy and even fun to use (Eddens et al., 2017). Stark and Krosnick (2017) demonstrated that this type of interactive tool was more enjoyable than a traditional egocentric network questionnaire, which can reduce the network data collection burden on the respondent. *But does this tool offer the same data accuracy as the existing paper and digital tools which have been in use for the past two decades? Is it truly perceived as less burdensome to the respondent than other methods?*

The primary aim of this study is to directly compare the accuracy, efficiency, and user satisfaction of the digital force-directed node-link diagram, as well as two other novel alter-tie tools invented for this study (the boxpop and the pilesort), to more traditional or widely used alter-tie data collection tools. We explore the research questions by implementing a randomized trial of 7 unique alter-tie collection tools. Participants view a common stimulus – a 15 min video clip from a television show where a number of characters interact – and then reproduce the interaction network they just saw using one of seven different alter-tie collection tools including paper, traditional online surveys, and OpenEddi (OE). Results from this study will inform future development, testing, and implementation of digital tools for alter-tie data collection in social network research.

## Methods

This study was exempted from review by the Institutional Review Board at the University of Kentucky.

### *Participants*

Participants were undergraduate students recruited from a research experience pool as partial fulfillment for their marketing, management, or finance course at a large university in the southeast United States. A total of 205 participants were included in the study. Inclusion criteria were being at least 18 years of age and the ability to read and understand English. Research was conducted during ten one-hour time slots over three days in one week in early 2016, in a behavioral research laboratory with semi-private cubicles containing computers and headphones.

### *Study design and randomization*

This study is a randomized experiment with seven conditions, each consisting of a different tool for collecting alter-tie data (See Figs. 2–4). The first three tools used OpenEddi (OE) software while the remaining four are more widely-used existing tools: 1) OE-Nodelink; 2) OE-Boxpop; 3) OE-Pilesort; 4) Digital Matrix; 5) Digital Pair List; 6) Paper Matrix; and 7) Paper Nodelink. Each of these conditions will be described in detail below. We used urn randomization (pulling a colored token out of a bag), sampled without replacement, to assign participants to the conditions. Participants were exposed to a standardized stimulus video showing interactions between characters on a television show, and were asked to report on the interactions between those individuals using one of the seven alter-tie collection methods. After completing the alter-tie task, participants responded to a survey on satisfaction with the tool, a manipulation check (attention to the video), previous exposure to the characters in the video, and demographics. Measures are detailed below.

### *Standardized stimulus / exposure to network*

A 14 min, 31 s embedded YouTube video clip portrayed one-half of the pilot episode of a popular, 30-minute, prime-time television comedy-drama that aired on American television from 1988 to 1993. This program was chosen because it would likely be unfamiliar to undergraduate students, yet it contained clear interactions between about a dozen distinct, named characters, within a few social groups. After watching the video, participants were asked to use one of the seven assigned methods to indicate which characters in the video spoke to one another at any point in the video.

### *Alter-tie method conditions*

The seven data collection methods are detailed below, beginning with the novel digital tools developed for the study (see Fig. 2):

#### *OE-Nodelink*

The OE-Nodelink condition is a digital force-directed node-link graph used in network visualization that can be created and manipulated dynamically, in real time, on the computer screen. The participant is presented with a screen on which all 12 nodes are displayed as circles with the characters' names within the nodes. Participants are instructed on how to use the tool, and asked to draw a line by clicking and dragging between circles with the characters' names to indicate that those two characters spoke to one another in the video. After each tie is added, the diagram reconfigures itself into a new layout. The layout algorithm is paused when the user initiates drawing a tie.

#### *OE-Boxpop*

The Boxpop tool developed out of the idea of reducing the page search behavior and keeping the user focused on a single part of the application (Sereno and Rayner, 2003). The respondents eyes remain fixed on a specific area of the page rather than having to drift around the page searching for names. The boxpop displays a pair of alter names on the screen with the ability to select "yes" or "no" in response to a prompt about the existence of a tie between the alters. In this study, the instructions are to indicate "yes" if either of the characters spoke with the other one in the pair. When the participant makes a selection, one of