Occupational Selection and the Reliability of Position Generator Measures of Social Capital

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Abstract

This article investigates how varying the social positions (occupations) presented by a position generator (PG) instrument affects the reliability of commonly-used egocentric network measures based on PG data. We modify the split-half design employed in Verhaeghe et al.'s (2013) study of university students for use with already-existing PG data on a national adult population. After replicating that study, we examine how reliability varies with the relational criterion that links an individual to an occupation and with the number of occupations in a PG. We find that most PG measures are only modestly reliable (i.e. relatively sensitive to occupational selection), but our absolute assessment of their reliability (given instrument length) is somewhat more optimistic than that of the prior study. Extensity (the number of positions with which a subject has contact) is the most reliable measure, composition measures based on class groupings are next, and those that involve socioeconomic standing or prestige scores are least reliable. Deeming someone to be connected to an occupation using an acquaintance criterion yields more reliable measures than requiring a stronger level of connectivity. PG measures based on longer (more occupations) instruments have higher reliability, and projections for longer PGs suggest that including 20 occupations could measure extensity and counts of contacts in some class groupings with adequate reliability; but other class composition measures and all measures involving socioeconomic standing or prestige scores would require 30 or more.

1. Introduction

Position generator (PG) instruments measure the social resources that reside within an individual's egocentric network by eliciting a survey respondent's contacts with a set of social locations. The locations are usually occupations — as in Lin and Dumin (1986) and much ensuing work — but occasionally they are other aggregates like political (Stockmann et al., 2020) or religious (Erzzati and Mozayani, 2016) groups. PG instruments are employed for studying relationships between aspects of social networks and socioeconomic attainment (e.g. Flap and Völker, 2008; Pena-López et al., 2021) as well as health (Song and Lin, 2009), access to cultural capital (Erickson, 1996), and social movement mobilization (Tindall et al., 2012), among other topics.

The set of positions/locations offered to respondents is a key feature of a PG; in keeping with most applications, we henceforth refer to the locations as "occupations." After a respondent's connections with occupations are ascertained, these data are combined with other information about the occupations to measure aspects of social capital such as social integration, network composition, and range/diversity. Those measures vary depending on the occupations included in a PG.

Such variations introduce unreliability into PG measures, and this article centers on that. Low reliability is problematic because it adds variation to regression coefficients in analyses that use PG data, potentially leading to between-study differences in findings; as well, it can bias estimates of such coefficients. To study it, we examine the extent to which PG measurement operations based on different sets of occupations score

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respondents consistently. We begin with the design and reliability assessment methods of a prior study (Verhaeghe et al., 2013) that addressed this question using a college student sample. After adapting them for use with already-existing data, we then apply them to a sample from the Dutch adult population, and extend the prior study in several directions. First, we report reliability estimates for a sample that represents a national adult population, with attention to how these differ across PG-based measures commonly used in research applications. Second, we demonstrate how reliability differs depending on the relational criterion that connects respondents and occupations. Third, we show that reliability varies with the length (number of positions/locations) of a PG, and project the reliabilities that can be anticipated for longer ones.

The following sections (2 and 3) discuss the background for our analyses and state our research questions. We cover the data base and the measures we use in section 4, and our methods of data analysis in section 5. Section 6 sets out our expectations about the relative levels of reliability we anticipate for different PG measures, and section 7 reports our findings. Section 8 summarizes them, discusses their implications for both designers of and analysts who use data from PG instruments, and concludes.

2. Background

A position generator is comprised of a battery of survey items asking respondents to indicate whether they are connected by some relational criterion to each of a set of occupations. Answers to these are then combined to construct measures that tap different aspects of a respondent's social capital. Most data analyses make use of the measures rather than the individual survey items themselves. We consider both the items and the measures in greater detail below.

By posing questions about a respondent's relationships involving categories or groups of people rather than individual alters, PGs assemble a form of aggregate relational data (Baum and Marsden, 2023; McCormick, 2020). While these provide much less granular detail about an egocentric network than do data collected by name generator (NG) instruments that elicit an individual's alters and relationships (e.g. Burt, 1984), they have two important advantages over the latter. First, they provide data on connections via weaker ties (e.g. acquaintances or people one "knows") more readily than typical NG instruments can. Second, PGs typically require substantially less time and effort from respondents than NG instruments do.

Ideally, a PG instrument would provide a full inventory of the social resources that a respondent might access via occupational contacts by obtaining information about her/his relationships to other persons holding all occupations in a society. In practice this is not possible because the number of occupational groups is greater than a survey can realistically accommodate.[1] PGs therefore present a selection of the occupations in which respondents might have personal contacts, and use responses about that subset to construct measures of social capital.

Some limited guidance exists about how subsets of occupations are to be chosen for a PG. Most instruments follow Lin and Dumin (1986) and Lin et al. (2001) by presenting occupations that are well-dispersed along a socioeconomic status or prestige gradient, or among class categories (Erickson, 1996). Verhaeghe et al. (2013, pp. 244–45) recommend that occupations represent a variety of economic sectors, and that the fraction of persons in the labor force that holds an occupation should be neither too large nor too small.[2]

Even if there are no issues of survey response error[3] it seems inevitable that survey responses about a respondent's contacts with occupations will differ across seemingly comparable sets of them. Someone might, for example, be friends with a police officer but not with a firefighter, or be acquainted with a mechanical engineer but not with a computer scientist. Depending on which occupations happen to be chosen, PG-based social capital indicators like the number of occupations in which the respondent knows someone, or the average socioeconomic standing of those occupations in which someone is known, will likewise differ.

[1] For example, Ganzeboom and Treiman (1996) enumerate 390 4-unit occupational groups in the 1988 International Standard Classification of Occupations (ISCO); Bian (2008) chose occupations for a PG from among more than 500 listings in the Chinese census; Sixma and Ultee (1984) provide prestige scores for 116 Dutch occupations.

[2] McCormick et al. (2010), for example, suggest that subpopulations presented should include 0.1-0.2% of the population.

[3] Among other things, this would mean that all respondents concur on what it means to "know" someone and for one of their contacts to be "in" an occupation (Van Der Gaag et al., 2012), and are capable of retrieving and accurately reporting those contacts from their memory (McCarty et al., 2001).

2.1. Verhaeghe et al. (2013) Study

Verhaeghe et al. (2013) previously posed the question of how much PG measures vary across different sets of occupations. To pursue it, they constructed 24 pairs of occupations, matched as closely as possible on Erikson, Goldthorpe and Portocarero (EGP) class code (Erikson et al., 1979; Erikson and Goldthorpe, 1992), International Socio-Economic Index (ISEI) score (Ganzeboom and Treiman, 1996), and Standard International Occupational Prestige Score (SIOPS; Treiman, 1977). They then formed two 24-item PGs, each of which included one occupation from each of the pairs. They administered these consecutively[4] via web survey to students at Ghent University in Belgium. Next, they used responses to these to calculate two scores for each respondent on 13 PG measures, and gauged the reliability of these measures by correlating the pairs of scores. They found that no measure reached the conventional 0.70 reliability level deemed adequate by Nunnally (1978), though one (for the number of occupations with which a respondent was acquainted) approached that level. Some EGP class composition measures had reliabilities near 0.6, while those for most measures involving ISEI or SIOPS scores were beneath 0.5.

This study is informative, and we replicate many of its findings below using other data. The authors note some of its limitations, most notably its student study population. Participants were relatively homogeneous in both age and education, which could limit "true" variation in social capital indicators and hence reduce reliabilities. The authors also suggest that many acquaintances reported may better reflect contacts of parents, rather than the students themselves, with others who hold particular occupations.

The design of the Verhaeghe et al. (2013) study follows the logic of split-half reliability (Johnson and Penny, 2005). This approach assesses the reliability of a lengthy multiple-item scale by dividing its items into two or more subsets, calculates scale scores for each of the latter, and correlates the sets of scores. The correlation estimates the reliability of a scale containing as many items as there are in each subset, but it can be used to project the reliability of the original, longer, scale.

Among the critiques of split-half reliability assessment is that any given division of the initial set of items into subsets is only one of many that are possible. From this standpoint, the two 24-occupation PGs studied by Verhaeghe et al. (2013) can be seen as subsets of a single 48-occupation PG. Restricting the possible subsets to include one occupation from each of the 24 matched pairs of occupations they constructed (thereby ensuring occupational diversity in each subset), there are nonetheless more than 8.3 million (2^{23}) possible replicate pairs of 24-item PGs; a different reliability can be calculated using each of these. We do not know how much these estimates vary from one another, or of course where the single value that Verhaeghe et al. (2013) report for each PG-based measure falls within such a distribution.

3. Research Questions

In the sections that follow we first address these limitations by repeating the Verhaeghe et al. (2013) study using the 30-occupation PG administered in the first (1999-2000) wave of the Survey of Social Networks of the Dutch (discussed further below). We compare our estimated reliabilities with those they report. How reliability varies across different PG measures is a second point of interest. For these analyses, we report a distribution of reliabilities for each measure, obtained by examining a large number of replicate pairs or triples of PGs that include subsets of the occupations in the original PG. In this way we illustrate the extent of uncertainty in estimates that is inherent in the split-half design.

Thereafter, we turn attention to two other facets of PG instruments. First, we consider the relational criterion, i.e. the type of relationship that establishes a connection between a respondent and an occupation. Analysts typically use a relatively weak standard — such as "knowing" or "being acquainted with" — when constructing PG measures, though most PGs also obtain data on other criteria. We ask how the reliability of PG measures changes when stronger thresholds such as friendship or kinship are employed.

Lastly, we engage the issue of how reliability varies with the number of occupations in a PG — what we term its length. The reliability of multiple-item attitude or opinion scales generally increases with their

[4]The two lists of occupations were separated by the statement "This is another list of 24 occupations." Occupations were presented in a random order within each list; about half of those invited to participate received one list first, while the other half were shown the other list first.

length, and we anticipate that this also will hold for PG measures. This part of our analysis can offer guidance about how many occupations a PG should include in order to attain measures that have a given level of reliability.

4. Data and Measures

This section first describes the survey from which the PG data we study come. We then discuss features of its PG items. Last, we specify the PG measures for which we will assess reliability.

4.1. The Survey of Social Networks of the Dutch (SSND)

We study data collected by the Survey of Social Networks of the Dutch (SSND; Flap et al., 1999; Flap and Völker, 2008), a multi-wave longitudinal study (see Tulin et al., 2021 for a report on its second and third waves). We examine only first-wave data collected in 1999-2000. Described in Völker and Flap (2003, pp. 179–82), it selected 40 municipalities in the Netherlands, from which it sampled neighborhoods and then addresses. It sought personal interviews (averaging nearly two hours duration) with a respondent aged 18-65 at those addresses; within households it selected the target interviewee by the next birthday method. Its realized sample size was 1,007, with a 40% response rate. Our analyses exclude 9 respondents who did not provide valid data on all 30 PG items, leaving N=998.

4.2. Position Generator Survey Items

We discuss PG items with reference to the PG instrument that appeared in the SSND. Like other PGs, its items include two elements: a set of occupations to which respondents may be connected, and a relational criterion specifying how a respondent is linked to an occupation.[5] It begins as follows (translation from Dutch as in Flap et al., 1999):

> Before asking you more questions about your work and your daily activities, I would like to know . . . the occupations [of people] you meet and have contact with. I have here a list of different occupations that people can have. Does anyone in your family have one of those occupations?
>
> Anyone among your friends?
>
> Among your acquaintances? [By] 'acquaintance' I do not mean [people like] the salespersons you come across in the shop, but somebody that you have a small talk [with] or would have a small talk with if you met him/her on the street and that you know by . . . name.

This sequence of three questions asking whether an occupation is held by a family member, a friend, or an acquaintance allows an analyst to designate any of those three types of tie as the relational criterion. Interviewers are instructed to skip to the next occupation after receiving the first "yes" answer, so only a respondent's closest connection (if any) to an occupation is recorded.[6]

The SSND asks respondents about their connections with 30 occupations. This is a relatively large number, an advantage for our purposes: using roughly 15 occupations (as in Lin et al., 2001) is common, but other extant PGs include as few as 6 (Hsung and Lin, 2008) and as many as 40 (Hällsten et al., 2015; Tindall and Cormier, 2008). Table 1 displays the occupations in the SSND PG, together with their ISEI (Bakker et al., 1997) and Sixma-Ultee (S&U) prestige (Sixma and Ultee, 1984) scores drawn from Van Der Gaag et al.

[5] Other PGs also include qualifiers specifying (e.g.) that those holding an occupation should be men or women (Erickson, 2008), or that they should reside within a specified geographic area (Contreras et al., 2019).

[6] It is possible, then, that respondents connected to an occupation via a family member are also connected to it through a friend or acquaintance (and those linked via a friend via an acquaintance as well); but those connected to the occupation by way of an acquaintance have neither a relative- nor a friend-mediated link to it. Other PGs employ a multiple response format that always (i.e., without any skipping) poses three questions like those in the SSND PG (e.g. Verhaeghe et al., 2013) for each occupation, or use a single dichotomous-response question about whether a respondent knows someone in an occupation, followed by a question about the type of that connection (Lin et al., 2001).

(2008, p. 31) and EGP class codes assigned by the authors.[7] Our analyses use the class groupings studied by Verhaeghe et al. (2013) — a higher service class (EGP code I), a lower service class (EGP code II), an intermediate class (codes IIIa-V) and a manual class (codes VI-VIIa) — rather than the finer groupings displayed in the table. We also consider composite service (codes I and II) and nonservice (codes III-VIIa) class groupings.

[7] Occupations are ordered as described in section 5.1 below, not in the order they were presented to respondents. We note that our coding assigns "trade union managers" to EGP class II, while Verhaeghe et al. (2013, p. 247) place "trade union manager/official" in class I. Our coding is based on the code provided by Ganzeboom and Treiman (1996, p. 221) for ISCO-88 occupation group 1142, "Senior officials economic-interest organizations (incl. Union Leader, Director Employers' Organization)."

2-Occupation Stratum	Occupation	EGP Class	ISEI	Sixma & Ultee Prestige	Jaccard Coefficient
A	Doctor	I	87	84	0.488
	Lawyer	I	83	86	
B	Scientist	I	71	65	0.423
	Policymaker	I	70	82	
C	Information technologist	I	70	68	0.600
	Director of a company	I	69	67	
D	Engineer	I	68	76	0.566
	Manager	II	69	67	
E	Teacher	II	66	62	0.165
	Trade union manager	II	65	66	
F	Higher civil servant	II	61	64	0.502
	Nurse	II	38	44	
G	Estate agent	IIIa	61	64	0.350
	Insurance agent	IIIa	54	52	
H	Secretary	IIIa	53	52	0.552
	Bookkeeper/accountant	IIIa	51	52	
I	Sales employee	IIIa	43	22	0.479
	Hairdresser	IIIb	30	39	
J	Farmer	IVc	43	36	0.396
	Musician/artist/writer	V	64	45	
K	Police officer	V	50	54	0.236
	Foreman	V	25	27	
L	Mechanic	VI	59	63	0.206
	Engine driver	VI	26	44	
M	Postman	VIIa	39	26	0.306
	Truck driver	VIIa	34	26	
N	Cook	VIIa	30	39	0.322
	Cleaner	VIIa	29	20	
O	Unskilled laborer	VIIa	26	15	0.417
	Construction worker	VIIa	26	15	

Table 1: Stratum Assignments, EGP Class Codes, and ISEI/Prestige Scores for Occupations in SSND PG Instrument

4.3. Position Generator Measures

A PG instrument yields a set of J indicator variables $\{x_{ij}\}$ for whether respondent i is connected to occupation j, where J is the number of occupations. These, together with other data about the occupations, are used to construct measures of different facets of social capital. While many such measures exist, we assess the reliability of those that appear frequently in substantive studies that rely on PG data (see Verhaeghe and Li (2015) for a helpful catalog of such measures and an assessment of the frequency with which they are used).

Most commonly employed is the "extensity" measure (Lin et al., 2001), which counts the number of occupations to which respondent i is connected:

$$extens_i = \sum_{j=1}^{J} x_{ij}. \tag{1}$$

This is indicative, roughly, of the size of a respondent's egocentric network.

Various scores assigned to occupations reflect their social standing or other features (e.g. sex composition); we use the symbol s_j to refer to a generic such score for occupation j. What Lin et al. (2001) term the "upper reachability" of a respondent's network refers to the maximum score of any occupation in which the respondent has a contact:

$$uppers_i = \max_{j:x_{ij}=1} \{s_j\}. \tag{2}$$

Measure (2) pertains to the composition of the respondent's social resources.

Lin et al. (2001) propose to tap the diversity of social capital within an egocentric network by calculating the range of scores s for those occupations within respondent i's network:

$$ranges_i = \max_{j:x_{ij}=1} \{s_j\} - \min_{j:x_{ij}=1} \{s_j\}. \tag{3}$$

To these foundational PG measures, Lin and Dumin (1986) and Verhaeghe et al. (2013) add another way of capturing network composition: the average score of the occupations to which a respondent is linked

$$avgs_i = \frac{\sum\limits_{j:x_{ij}=1} s_j}{extens_i}. \tag{4}$$

We calculate the maximum (2), range (3) and average (4) using both ISEI and S&U prestige scores.[8]

Still another composition measure is the number of occupations in respondent i's network that are coded within a given EGP class c_k:

$$classk_i = \sum_{j:j\in c_k} x_{ij}, \tag{5}$$

where c_k is the k^{th} class. Measure (5) is a subscale of the extensity measure (1). Following Verhaeghe et al. (2013), we assess the reliability of such measures for the four class groupings specified by Erikson and Goldthorpe (1992), as well as for the composite service and nonservice ones.

Finally, we examine the reliability of scores from a principal component analysis of the extensity (1), upper reachability (2) and range (3) measures

$$pcs_i = w_e extens_i + w_u uppers_i + w_r range_i, \tag{6}$$

where w_e, w_u and w_r refer to the respective coefficients for calculating the first principal component score (pcs). Pena-López et al. (2021), among others, employ such composite measures. We calculate separate pcs scores (6) using upper reachability and range measures based on both the ISEI and S&U prestige metrics.

[8]For measures (2)-(4) that involve scores s_j, the question of how to treat cases that have an extensity value (1) equal to 0 arises. Imputing a value of 0 for these measures, as in Verhaeghe and Li (2015), may not be reasonable because 0 is lower than the minimum possible value for both ISEI and S&U prestige. As Verhaeghe et al. (2013) did, we have excluded such cases here (there are relatively few of them: for the full 30-occupation SSND PG based on an acquaintance criterion, only 2 respondents have 0 values on the extensity measure. The number of excluded cases rises, of course, when we divide the occupations into subsets or use friendship or kinship rather than acquaintance as the relational criterion). Because their low extensity score indicates that their networks are likely small, however, a regression-based approach to imputing values for such cases on measures (2)-(4) may have some appeal.

5. Methods

Ascertaining a measurement instrument's reliability requires the availability of two or more interchangeable versions of it. This section first explains how we organized the 30 occupations in the SSND PG into comparable subsets, next constructed all possible PG forms of a particular length that include one occupation from each of those subsets, and then grouped those forms into replicate pairs or triples. Finally, we discuss the statistic we use to measure reliability, the intraclass correlation coefficient.

5.1. Design for Assigning Occupations to Strata

In accordance with standard PG design recommendations (Lin et al., 2001), the different PG forms we compare should include occupations that are similarly distributed across different levels of social standing. Verhaeghe et al. (2013) enforced this by selecting pairs of occupations that have similar ISEI and SIOPS scores and EGP codes. Because we study already-existing data, we cannot follow their procedure directly. In place of it, we sorted the 30 SSND occupations, first by EGP code and then by ISEI score.[9] This led to the ordering of occupations shown in Table 1; we then grouped adjacent pairs of occupations into what we term "strata", labeled A-O in the table.

In general, the characteristics of the pairs of occupations within strata exhibit substantial similarity. Stratum O is an extreme case; its occupations have identical ISEI, S&U prestige, and EGP class values. Several other strata (A, C, E, H, M, N) approach this. In other strata, though, appreciable differences exist.[10] The occupations in stratum K have ISEI scores that differ by 25 points, for example. Stratum D is notable because one of its occupations (engineer) is in the higher service EGP class, while the other (manager) is in the lower service grouping. We acknowledge these differences, and below we assess their impact on our findings for those measures that involve occupational characteristics.

For our analyses that involve PG forms with fewer than 15 occupations (section 7.3), we created 3-occupation strata by combining sets of three contiguous 2-occupation strata in Table 1. For example, strata A-C were merged into two 3-occupation strata including doctors, lawyers, and scientists, and policymakers, information technologists, and directors of companies.

5.2. Creating PG Forms and Measures for Replicate Groups of PG Forms

We next construct all of the possible PG forms that contain one of the occupations in each stratum, and group these into replicate pairs or triples. For 15-occupation PG forms, this is straightforward: we begin by assigning one occupation in stratum A to the first form in a pair, and the other occupation to the second form. Continuing, we alternately assign the occupations in other strata to the two forms, rotating the assignments most slowly for stratum B and most rapidly for stratum O; see the Appendix for a more detailed discussion and illustration. This leads to $2^{14} = 16,384$ replicate pairs of 15-occupation PGs. For each of those pairs we then calculate the above-described PG measures separately for the two forms, and assess reliability as described in the following section.

For analyses that involve PG forms with fewer than 15 occupations each, this process is more complicated because a given PG form can be matched with more than one other form consisting of distinct occupations. First, we merged sets of contiguous 2-occupation strata into 3-occupation strata as described above. To construct 14-occupation PGs, for example, we created two 3-occupation strata, leaving 12 of the initial 15 2-occupation strata intact. We then assigned occupations from the 2-occupation strata to PG forms in the manner just discussed, and extended the rotation design to add pairs of occupations from the 3-occupation strata. Again, the Appendix provides additional details and examples. This led to $2^{11}3^2 = 18,432$ replicate pairs of 14-occupation PGs. We further reduce the number of occupations per PG form by merging additional sets of three contiguous 2-occupation strata; merging all five such sets results in $3^9 = 19,683$ replicate triples of 10-occupation PGs.

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[9]We repeated our analyses of 15-item replicate pairs (Table 2) using strata that take S&U prestige rather than ISEI as the secondary sort key, and found no differences of note. We therefore conducted the remainder of our analyses using the EGP/ISEI-based stratification, on grounds of its applicability outside the Netherlands.

[10]ISEI scores also differ in some of the Verhaeghe et al. (2013) pairs, though those differences are usually smaller than ours. The largest (18 points) is for their ninth pair (clerical and related workers, and printers and related workers).

5.3. Assessing Reliability

We measure reliability using the intraclass correlation coefficient (ICC; Shrout and Fleiss, 1979). We model y_{rf}, respondent r's score on a PG measure for PG form f within a replicate pair or triple, as

$$y_{rf} = \mu + \alpha_r + \beta_f + \gamma_{rf} + \epsilon_{rf}, \quad (7)$$

where μ is a constant term, α_r is a respondent effect, β_f is a form effect, γ_{rf} is an interaction of respondents and forms, and ϵ_{rf} is an error term. We treat the form effects $\{\beta_j\}$ as fixed,[11] and the remaining terms as random.

The "true" variance among respondents is estimated by the variance of the $\{\alpha_r\}$, σ_r^2. With one observation y_{rf} per respondent, we cannot separate γ_{rf} and ϵ_{rf}, so the "error" variance σ_{rf}^2 sums the variation in y_{rf} attributable to those two terms. Using these components we construct the ICC (ρ) as

$$\rho = \frac{\sigma_r^2}{\sigma_r^2 + \sigma_{rf}^2}. \quad (8)$$

Measure (8) gives the extent to which respondent's scores are consistent across PG forms. For replicate pairs, it tends to be very slightly smaller than the Pearson correlation coefficient reported by Verhaeghe et al. (2013). We use the ICC rather than the Pearson correlation because it also allows us to assess the reliability of replicate triples of 10-item PGs.

6. Expectations about the Reliability of PG Measures

Key to the reliability of PG measures is the extent of within-respondent concurrence about having contact with others who hold the occupations grouped within strata. To the degree that respondents are in contact with both occupations within a stratum, PG measures will be robust to occupational selection there. If such agreement is high in all strata, all PG measures should display high reliability. We assess such within-stratum concordance via the Jaccard coefficient $n_{11}/(n_{11} + n_{10} + n_{01})$, where n_{11} is the number of respondents in contact with both occupations in a stratum, n_{10} is the number in contact with the first but not the second occupation, and n_{01} is the number linked to the second but not the first (Shoukri, 2004, p. 24).

The within-stratum Jaccard values, with contact defined as having any acquaintance in an occupation, appear in the last column of Table 1. These lie well beneath the maximum possible value of 1.0, implying some appreciable differences in whether respondents claim to have contact with both occupations assigned to a stratum, and therefore PG measures having less than perfect reliability. Agreement tends to be somewhat higher, often near or above 0.5, for strata composed of higher ISEI/prestige and service class occupations. The highest level is for stratum C (information technologists and directors of companies), while the lowest is for stratum E (teachers and trade union managers).

Expectations about the relative reliability of particular PG measures rest primarily on their structure, that is, on how they combine the component PG items $\{x_{ij}\}$ and occupation scores $\{s_j\}$. Like many attitude/opinion scales, the extensity measure (1) and the class composition measures (5) are sums of (subsets of) the $\{x_{ij}\}$. As such, we anticipate that those measures will be more reliable to the extent that they involve more occupations, and tendencies for respondents to be connected to pairs of occupations involved in a measure are stronger.

Because extensity (1) includes all occupations in a PG form, we expect that its reliability will be comparatively high. The EGP composition measures (5) are shorter scales; 15-occupation PGs for the strata in Table 1 include (on average) 3.5 higher service, 2.5 lower service, 5 intermediate, and 4 manual class

[11] In any given replicate pair or triple, all respondents are scored based on the same forms. Moreover, any variance attributable to forms is induced by our research design, and hence nonsubstantive. On both grounds it is appropriate that variance due to form differences be excluded from the denominator of (8).

occupations.[12] Contact with pairs of occupations in particular classes tends to be more closely associated than is that with pairs of occupations in general. To illustrate this, Figure 1 depicts a metric multidimensional scaling based on Jaccard coefficients for concordance in contact with all pairs of the 30 SSND occupations. Notable is the clustering of occupations within class groupings (indicated by color variations), especially for the service class occupations toward the left of the figure. This tendency for contacts with occupations within an EGP class grouping to be well associated compensates to an extent for the shorter length of the class composition scales, suggesting that these measures too may prove to be relatively reliable.

Turning to measures that also depend on scores $\{s_j\}$, we note that the upper reachability (2) and range (3) measures involve extreme (maximum, minimum) values of respondent-specific distributions of scores, rather than sums. Because of their sensitivity to the level of agreement within one or two strata, we expect them to be less reliable than the extensity or class composition measures.[13] The reliability of the average score measure (4) should benefit from aggregation across multiple occupations as the latter measures do, but it involves only those occupations to which a given respondent is connected, rather than all of them; hence it may prove to be only somewhat reliable.

The second-order pcs measure (6) is based on what the extensity (1), upper reachability (2) and range (3) scores have in common. As such its reliability would seem to depend on those of its component elements; but we approached the analysis without strong ex ante expectations about it.

7. Results

Our findings appear in the three following subsections. First, we assess the reliabilities of the 15 PG measures for 15-occupation PGs based on the SSND data, and compare them with the results reported by Verhaeghe et al. (2013). Next, we ask how the reliability of those measures differs if we connect respondents to occupations by way of a kinship or friendship tie rather than the acquaintance or "knowing" standard typically used to construct them. Last, we demonstrate how reliability varies with the length of a PG instrument.

7.1. Reliabilities for 15-Occupation PG Instruments

As explained, we enumerated all 16,384 ways of constructing pairs of 15-occupation PGs that include one occupation from each of the strata shown in Table 1. We calculated each of the above measures for both PGs and then obtained an ICC for each measure in both forms in all pairs. Table 2 presents six-number summaries of the distributions of these.[14]

[12] Fractions indicate that the numbers of occupations assigned to a class grouping cannot be evenly divided between PG forms; they give the average number found in a form. Pairs of 15-occupation PGs, for example, have 4 higher service occupations in one form and 3 in the other, an average of 3.5. Using EGP class as the primary sort key for constructing strata prevents more extreme (5-2, 6-1, 7-0) splits of the higher service occupations between the forms.

[13] Figure 1 shows, however, that agreement about being acquainted with persons in occupations is well-ordered by ISEI. This, we expect, heightens the reliability of the score-based measures.

[14] These ICCs are not, of course, independent of one another. While the PG forms in all replicate pairs include disjoint sets of occupations, many pairs of PGs closely resemble one another, and hence are apt to have similar ICC values.

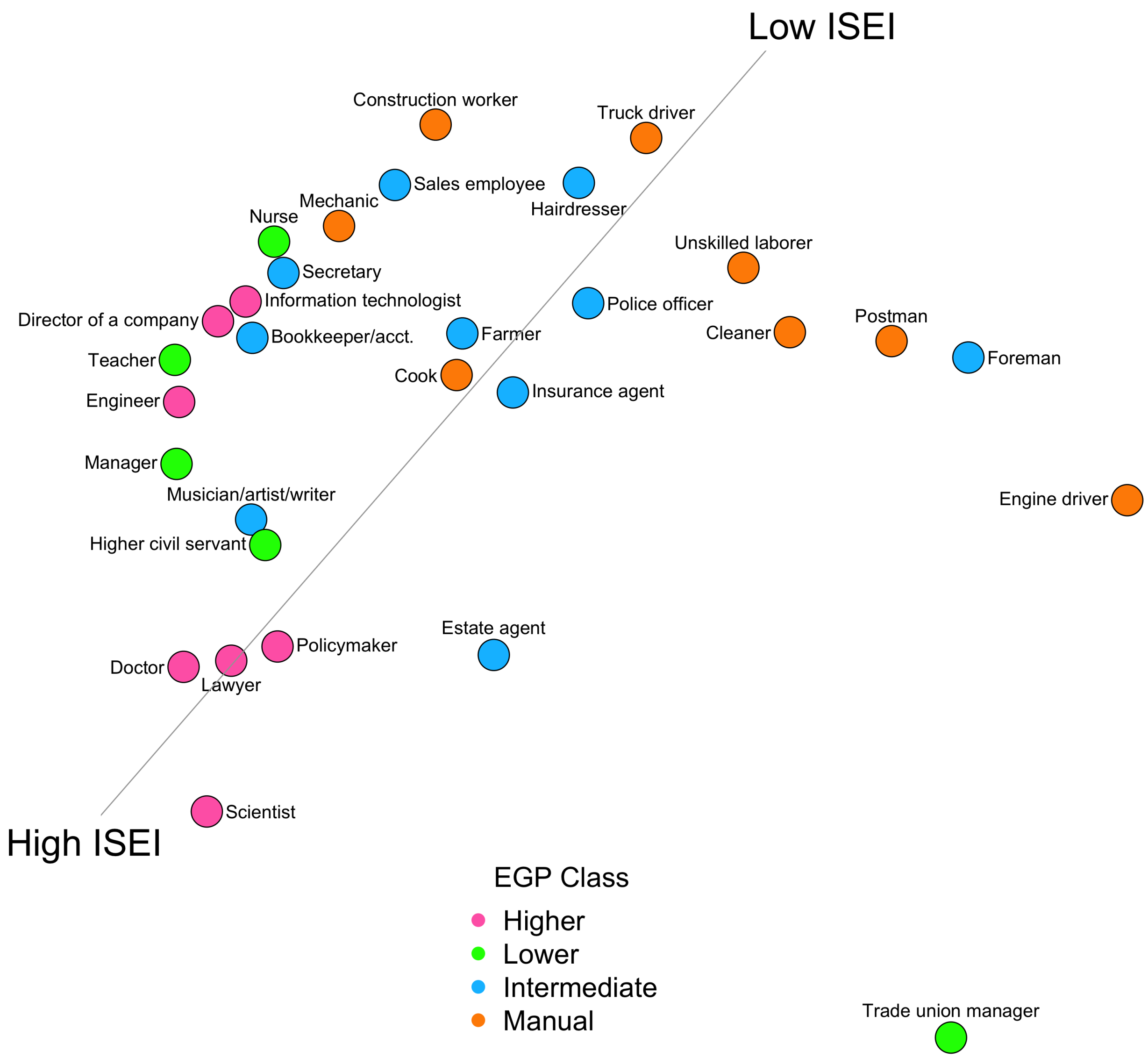

Figure 1: Metric Multidimensional Scaling (MDS) Diagram of SSND Occupations Based on Jaccard Coefficients. Colors indicate an occupation's EGP class grouping. The diagonal line from the upper right (low ISEI) to the lower left (high ISEI) depicts a linear regression (through the origin) of an occupation's ISEI score on its horizontal and vertical MDS coordinates. $R^2 = 0.80$ for that regression, so the occupations are well-ordered by ISEI within this plot.

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.	Verhaeghe et al. Study (24 occupations)
Extensity		0.652	0.696	0.706	0.706	0.717	0.757	0.688
Maximum	ISEI	0.354	0.402	0.413	0.411	0.422	0.453	0.574
	S&U Prestige	0.312	0.374	0.390	0.390	0.407	0.468	0.432 (SIOPS)
Range	ISEI	0.305	0.378	0.396	0.396	0.414	0.479	0.419
	S&U Prestige	0.293	0.369	0.387	0.387	0.406	0.473	0.322 (SIOPS)
Average	ISEI	0.368	0.444	0.462	0.461	0.480	0.544	0.362
	S&U Prestige	0.326	0.414	0.433	0.432	0.451	0.523	0.317 (SIOPS)
PCS	ISEI	0.494	0.545	0.558	0.558	0.571	0.615	(not reported)
	S&U Prestige	0.489	0.543	0.556	0.556	0.569	0.611	(not reported)
Counts in EGP Class Groups								
# Service		0.566	0.590	0.606	0.605	0.622	0.637	0.630 (12 occupations)
# Nonservice		0.570	0.601	0.614	0.614	0.627	0.655	0.587 (12 occupations)
# Higher Service		0.502	0.516	0.518	0.520	0.529	0.531	0.607 (5 occupations)
# Lower Service		0.185	0.245	0.267	0.260	0.282	0.321	0.456 (7 occupations)
# Intermediate		0.441	0.462	0.478	0.474	0.485	0.513	0.335 (4 occupations)
# Manual		0.402	0.446	0.453	0.452	0.462	0.489	0.525 (8 occupations)

Note: Distribution based on 16,384 replicate pairs.

Table 2: Distributions of Reliability Values for Measures Based on 15-item PGs

We first examine the distribution for the extensity measure (1), that is, the number of occupations in which a respondent is at least acquainted with someone. Its median and mean are very similar (as they also are for the remaining measures), just above the Nunnally (1978) threshold value of 0.70; extensity is the only measure with a reliability above this guideline. The middle 50% of the distribution of reliability values is tightly packed around its center, ranging from a first quartile of 0.696 to a third quartile of 0.717, an interquartile range (IQR) of 0.021. The lowest quarter of the distribution lies between its minimum (0.652) and 0.696, while the highest one extends from 0.717 to a maximum ICC of 0.757. So depending on which partition of the 30 SSND occupations into two 15-occupation subsets one selects, the reliability estimate for extensity varies within a range of just over 0.10.

Distributions of reliabilities for most of the remaining 14 PG measures also display considerable variability. That for the average S&U prestige score of the occupations in which a respondent has a contact has both the largest IQR (0.037) and the broadest range (0.197). In general, reliabilities for the measures that involve scores s_j (maximum, range, average, and pcs) are more dispersed, while those for contacts with occupations in particular EGP class groupings vary less. A respondent's number of contacts with occupations classified in the higher service group has the smallest IQR (0.013) and range (0.029).

The principal feature distinguishing the reliability measures for different PG measures is, however, their central tendency. Our remaining remarks about Table 2 concentrate on this.

The median reliabilities for numbers of contacts within EGP class groupings range from very poor (0.267, lower service group) to moderate (0.614, composite nonservice group); that for the composite service group is nearly as high as the latter (0.606). The low value for the lower service group arises in part because this subscale is the shortest: an average 15-item PG includes only 2.5 occupations in this group. Also contributing is the low overlap between knowing one lower service occupation (trade union manager) and the others in this group; observe that this occupation is in an outlying (lower right) position in Figure 1.

As we anticipated, the median reliabilities of score-based measures (maximum, range, and average) tend to be lowest, ranging between 0.387 (range of S&U prestige) and 0.462 (average ISEI). Those based on ISEI scores are slightly higher than those for S&U prestige.[15] Of these measures, the average performs best and the range least well. In general, though, the score-based measures appear to be most sensitive to occupational selection decisions.

The ISEI and S&U prestige versions of the pcs measure have nearly identical median reliabilities just beneath 0.56. Although these abstract what is shared by the extensity, maximum, and range measures, they prove considerably less reliable than the extensity measure alone. Evidently the low reliabilities of its maximum and range components reduce the repeatability of this summary measure.

Our discussion of Table 2 concludes by comparing our median reliabilities to those reported by Verhaeghe et al. (2013); Table 2 presents the latter in its last column. Several caveats about these comparisons should be entered at the outset. Our results are based on data from in-person interviews with a cross-section of Dutch adults, while those of Verhaeghe et al. (2013) draw on a web survey of Belgian university students. We present a full distribution of possible reliabilities, whereas Verhaeghe et al. (2013) report one draw from such a distribution; they employ SIOPS prestige scores, while we use the S&U prestige scores assigned to SSND occupations by Van Der Gaag et al. (2008). Perhaps most pertinent is that our results assess the reliability of measures using 15-occupation PGs; Verhaeghe et al. (2013) do so for a pair of 24-occupation instruments.[16]

Of the 13 PG measures for which we can make a comparison,[17] our median reliabilities exceed the corresponding Verhaeghe et al. (2013) figures for six, and are smaller than theirs for seven. Our medians are higher for extensity, prestige range, both average score measures, and two EGP class composition measures (for the intermediate and composite nonservice groupings). The Verhaeghe et al. (2013) correlations are higher than our median ICCs for both maximum score measures, ISEI range, and the remaining four EGP measures. Our median results are 0.1 or more higher for both average measures and the EGP intermediate class count; theirs are at least that much larger than ours for the maximum ISEI score and the count in the lower service grouping.

We do not have a full account for all of these differences, but scale length appears to be a very important factor, as we demonstrate below in section 7.3. For the extensity and score-related measures, the Verhaeghe et al. (2013) PG instrument is 1.6 times longer than ours; we shall see later that once we take scale length into account, almost all of the SSND measures have reliabilities that appreciably exceed those that Verhaeghe et al. (2013) report.

The issue of scale length also pertains to comparisons of the EGP composition measures, but there we must be attentive to differences between the studies in subscale length, i.e. the numbers of occupations within the various class groupings. Differences between studies in these are quite substantial in some instances. The 24-occupation PGs in Verhaeghe et al. (2013) place 12 occupations in the composite service class, compared to the 6 in our 15-occupation PGs, and likewise include twice as many manual class occupations per PG (8) as ours do (4). The PGs studied in Table 2 include only 2.5 lower service occupations (on average), whereas those in Verhaeghe et al. (2013) contain 7. These differences certainly play a part in accounting for divergences in the findings of the two studies.

7.1.1. Unreliability Attributable to Within-Stratum Score Disparities

Despite our *ex ante* efforts to construct homogeneous occupational strata, some substantial differences in ISEI and S&U prestige scores within the strata in Table 1 are evident. Due to these, the unreliability in PG

[15] Some, but not all, of these S&U-ISEI differences are attributable to our decision to sort by ISEI rather than prestige when forming the strata in Table 1. When we repeated the analyses using prestige instead of ISEI as the secondary sort key, the differences between median reliabilities for the ISEI and prestige versions became slightly smaller; but the medians for the ISEI versions remained slightly larger than those for prestige.

[16] Also, as explained above, we use the ICC rather than the Pearson correlation as our reliability measure. We calculated Pearson correlations for the replicate pairs in Table 2, however, and found that their distributions differ little from those of the corresponding ICCs.

[17] Verhaeghe et al. (2013) do not examine the pcs measures.

measures involving scores $\{s_j\}$ — maximum, range, average, and pcs — are traceable to two sources. First, respondents may have acquaintances in different occupations in a stratum; this is our concern in this study. Second, the scores for the occupations may differ, so a respondent's value on a measure for the two forms in a replicate pair can diverge even when that respondent knows people in both occupations in a stratum.

For this reason, the score differences make some findings in Table 2 ambiguous. To ascertain the extent to which they are due to score differences within strata, we contrived a stratification design in which the occupations within strata are perfectly matched, by setting scores for the occupations in the same stratum to their mean; for example, we assigned ISEI values of $\frac{(87+83)}{2}$ to both doctors and lawyers in stratum A. We then repeated the analyses in Table 2. Table 3 reports median ICCs from these analyses and compares them with those for the corresponding measures from Table 2.[18]

PG Measure	Occupation Score	Median Reliability: Actual Scores	Median Reliability: Equated Scores
Maximum	ISEI	0.413	0.410
	S&U Prestige	0.390	0.425
Range	ISEI	0.396	0.416
	S&U Prestige	0.387	0.410
Average	ISEI	0.462	0.437
	S&U Prestige	0.433	0.437
PCS	ISEI	0.558	0.558
	S&U Prestige	0.556	0.573

Note: Based on 16,384 replicate pairs.

Table 3: Median Reliability Values for Measures Based on 15-item PGs: Actual and Equated ISEI/Prestige Scores Within Strata

If the low reliability of a measure is affected strongly by the within-stratum score discrepancies in Table 1, the median ICCs after scores are equated should be substantially above their Table 2 counterparts. They are not. Instead, we see only small rises, of no more than 0.035 (for maximum prestige). In two instances (maximum and average ISEI), we actually observe smaller median ICCs after equating the scores.[19] We conclude that only a small portion of the low reliability of these measures can be attributed to the score differences. Within-respondent disagreement about acquaintance with persons in similar occupations is the principal factor responsible for them.

7.2. Reliability of PG Measures for Different Relational Criteria

We next investigate how the relational criterion that determines whether or not a respondent is linked to an occupation affects PG measure reliability. Most PG instruments elicit data that allow an analyst to choose among several such criteria, but in practice a standard of acquaintance or knowing is virtually always employed. This is, of course, reasonable in that inclusion of weaker-tie contacts is regarded as a virtue of

[18] Full summaries of the distributions of these measures, parallel to those in Table 2, are available in the Supplementary Material.

[19] These declines may seem anomalous, as they initially did to us; we inspected several cases closely. They may be understood by referring to an expression for the ICC we use, $\frac{\mathrm{Cov}(y_{r1}, y_{r2})}{\sqrt{\mathrm{Var}(y_{r1})\mathrm{Var}(y_{r2})}}$. Equating scores within strata affects the scores $\{y_{rf}\}$ and their means $\{\bar{y}_f\}$, and hence both the covariance (numerator) and variance (denominator) terms of the ICC. More often than not, the numerator term rises proportionately more (or falls proportionately less) than the denominator one does after scores within strata are equated, thereby producing the generally higher median ICCs for analyses with equated scores in Table 3. This does not always occur, however; when it does not, the ICC with equated scores can be smaller than that with the actual ones.

such instruments. Nonetheless, answering a question about whether any of one's acquaintances holds an occupation requires that a typical respondent take inventory of her or his connections with hundreds of alters (e.g. Lubbers et al., 2019). Doing so for a smaller number of friends or relatives about whom a respondent is more knowledgeable might well prove to be a less challenging and more readily accomplished task.

We examined this issue using the SSND PG instrument that records a respondent's strongest relationship with an occupation, applying three criteria of connectivity, via: (a) a relative only; (b) a friend or relative; and (c) any acquaintance. We repeated the prior analyses using criteria (a) and (b); Table 4 presents median reliabilities from these, also redisplaying those for (c) from Table 2 for convenience.

PG Measure	Occupation Score	Relationship with Alter in Occupation		
		Relative	Friend or Relative	Any Acquaintance
Extensity		0.545	0.544	0.706
Maximum	ISEI	0.285	0.347	0.413
	S&U Prestige	0.279	0.318	0.390
Range	ISEI	0.280	0.270	0.396
	S&U Prestige	0.290	0.278	0.387
Average	ISEI	0.353	0.412	0.462
	S&U Prestige	0.337	0.395	0.433
PCS	ISEI	0.388	0.421	0.558
	S&U Prestige	0.396	0.422	0.556
Counts in EGP Class Groups				
# Service		0.436	0.493	0.606
# Nonservice		0.442	0.465	0.614
# Higher Service		0.316	0.395	0.518
# Lower Service		0.174	0.152	0.267
# Intermediate		0.265	0.301	0.478
# Manual		0.337	0.359	0.453

Note: Based on 16,384 replicate pairs.

Table 4: Median Reliability Values for Measures Based on 15-item PGs: Differing Relational Criteria

The outcome of these analyses is clear and consistent: PG measures based on an acquaintance criterion are appreciably less sensitive to occupational selection decisions than are those that require at least a friendship; those using a standard of kinship are least reliable. The median reliability of almost all measures falls as we strengthen the criterion from (c) to (a), the sole exception being their near equivalence under (a) and (b) for extensity.

This result is not, in retrospect, surprising. The three criteria are nested within one another (e.g. friends and relatives are a subset of all those known somehow). We have seen that low agreement in contact with occupations within strata is a key condition that limits the reliability of measures, and agreement tends to be higher when the overall fractions of respondents connected to a pair of occupations grow. Within-stratum agreement levels on criterion (a) are lower than those for (b), which in turn are beneath those for (c); see the table of Jaccard coefficients in the Supplementary Material. We hence conclude that the most commonly used relational criterion for constructing PG measures — acquaintance — also yields the most reliable measures.[20]

7.3. PG Length and Reliability

Apart from selecting particular occupations, those designing PGs must decide how many occupations to include in an instrument. Additional occupations presumably enhance the quality of PG measures, but also impose a higher respondent burden and compete with questions about other topics for space in a survey questionnaire. Verhaeghe et al. (2013, p. 214) note that PGs usually include between 12 and 30 occupations, and many have close to 15. Little methodological research informs decisions about PG length, however.

We suggest that reliability (limited sensitivity to occupational selection) can be one useful standard here. Using the SSND data, we examined how reliability varies with PG length by assessing it for PGs with between 10 and 15 occupations. To do so, we merged triples of three 2-occupation strata into pairs of 3-occupation strata as detailed in section 5.2 and then assessed the reliability of measures for replicate pairs or triples of PG forms constructed using those strata.

Median reliabilities for these analyses are shown in Table 5.[21] The main message they convey is that the reliability of each measure increases with PG length. For most, the rate of increase generally slows as a PG lengthens by one additional occupation. These patterns were anticipated for extensity, an additive scale; we were less confident about them for the score-based measures. For the maximum and range measures, it appears that inclusion of additional occupations makes measures more robust when a respondent is acquainted with only one occupation in an extreme stratum. We conjecture that having an additional occupation reduces the average score differential separating immediately adjacent strata, thereby limiting the reduction in a measure's reliability in cases of within-respondent inconsistency. We note that the score-based measures have low reliabilities at all PG lengths, however.

[20] Full summaries of the distributions of the ICCs in Table 4 are presented in the Supplementary Material.

[21] We found that the reliability distributions for some measures differed appreciably depending on which sets of 2-occupation strata we chose to merge. For this reason, when working with PGs of length 11-14, we repeated our analyses using all sets of triples of contiguous 2-occupation strata that could be merged, considering strata A-C, D-F, G-I, J-L, and M-O as possibilities. With 14-occupation PGs, for instance, we conducted separate analyses after merging each of these sets of three strata, leaving the remaining 2-occupation strata intact. This generates large numbers of replicate pairs; the results in Table 5 pool these analyses for PGs of a given length. Full summaries of these distributions are presented in the Supplementary Material.

PG Measure	Occupation Score	Number of Occupations in PG					
		10	11	12	13	14	15
Extensity		0.614	0.638	0.658	0.676	0.692	0.706
Maximum	ISEI	0.314	0.344	0.373	0.392	0.404	0.413
	S&U Prestige	0.299	0.326	0.347	0.365	0.379	0.390
Range	ISEI	0.308	0.336	0.352	0.368	0.384	0.396
	S&U Prestige	0.312	0.340	0.352	0.365	0.376	0.387
Average	ISEI	0.359	0.380	0.403	0.424	0.444	0.462
	S&U Prestige	0.325	0.349	0.371	0.393	0.414	0.433
PCS	ISEI	0.465	0.498	0.516	0.532	0.546	0.558
	S&U Prestige	0.463	0.495	0.513	0.529	0.543	0.556
Counts in EGP Class Groups							
# Service		0.504	0.526	0.551	0.567	0.594	0.606
# Nonservice		0.510	0.536	0.559	0.580	0.598	0.614
# Higher Service		0.407	0.422	0.433	0.502	0.516	0.518
# Lower Service		0.196	0.235	0.248	0.265	0.265	0.267
# Intermediate		0.363	0.383	0.414	0.441	0.464	0.478
# Manual		0.340	0.362	0.399	0.414	0.447	0.453
# Replicate Groups		19,683	131,220	233,280	207,360	92,160	16,384

Table 5: Median Reliability Values for Measures Based on PGs Including 10-15 Occupations

The reliabilities of the EGP class composition measures rise less steadily than the others do; note in particular the large increase between 12 and 13 occupations for the higher service grouping. They do rise, however, and we note that at shorter subscale lengths, PG forms can contain very few occupations in a given grouping. Some 10-occupation PGs, for example, include only one lower service occupation. We conjecture that this might be one factor underlying the more irregular rises in their reliabilities.

Establishing that PG measures become more reliable as a PG instrument's length grows from 10 to 15 is important, notwithstanding the fact that Table 2 demonstrates that even reliabilities based on 15-occupation versions are — in almost all instances — beneath the 0.70 level ordinarily taken as adequate. The results in Table 5 provide a foundation for anticipating reliabilities for measures from longer PGs, which can offer guidance about PG length.

7.3.1. Projecting the Reliability of Longer PGs

As noted, one purpose of the split-half method is to assess the reliability of a multiple-item scale. It accomplishes this by dividing the scale's component items into two halves, calculating scale scores for each half, correlating them, and using that correlation to forecast the reliability of the initial longer scale. This last step is accomplished via the Spearman-Brown prophecy formula (Johnson and Penny, 2005),

$$\rho_k = \frac{k\rho}{1 + (k\text{-}1)\rho}, \tag{9}$$

where ρ_k is the projected reliability for a scale k times longer than that of the forms used in obtaining ρ, the calculated ICC. The constant k is 2 for split halves, but the formula can be applied with any positive value of k; when $k < 1$ one is using it to project the reliability of a shorter scale.

These methods were derived for use with additive scales like extensity (1). Before using (9) to project the reliability of measures from longer PGs, we applied it to predict the median reliabilities for the shorter scales shown in Table 5 from the median extensity ICC for 15-item PGs (Table 2). This check proved to be encouraging: downward projections based on (9) matched Table 5's extensity medians to 3 decimal places, excepting a projected median of 0.616 rather than the observed 0.614 for 10-occupation PGs.

Next we projected the reliability of the extensity measure for 20-, 25-, and 30-occupation PGs from the 15-occupation median, as shown in the first line of Table 6. Its anticipated reliability for a 25-occupation instrument is 0.800, appreciably above the 0.688 that Verhaeghe et al. (2013) obtained empirically using their 24-occupation forms. Also notable is that our projected reliability of 0.828 for a 30-item PG is above the 0.815 value of Cronbach's α we calculated for extensity using all 30 SSND occupations and an acquaintance criterion. Cronbach's α is the average of all possible split-half reliabilities that can be calculated for a set of items (Johnson and Penny, 2005).[22]

[22] Our analyses do not examine all possible split-half reliabilities for 30 items, only the 16,384 replicate pairs obtained by selecting one occupation from each of the strata we constructed. In all, some $0.5 * \binom{30}{15} = 77,588,760$ split-half reliabilities could be calculated using 30 items. We conjecture that reliabilities might be higher for the subset of replicate pairs we selected than for all possible replicate pairs; in our pairs, the class/ISEI distributions of occupations are similar for both forms, and Figure 1 shows that class and ISEI underlie tendencies to be acquainted with pairs of occupations. If our conjecture is correct (we have not demonstrated that it is, however), one would expect our projected reliability for extensity to exceed the α value estimated using all SSND occupations.

PG Measure	Occupation Score	Number of Occupations in PG 15	20	25	30
Extensity		0.706	0.762	0.800	0.828
Maximum	ISEI	0.413	0.484	0.540	0.584
	Prestige	0.390	0.460	0.516	0.561
Range	ISEI	0.396	0.467	0.523	0.568
	Prestige	0.387	0.457	0.513	0.558
Average	ISEI	0.462	0.534	0.589	0.632
	Prestige	0.433	0.504	0.560	0.604
PCS	ISEI	0.558	0.627	0.677	0.716
	Prestige	0.556	0.625	0.676	0.715

Count in EGP Class Group	Size of Class Group in PG 4	6	8	10
# Higher Service	0.551	0.648	0.711	0.754
# Lower Service	0.368	0.466	0.538	0.593
# Intermediate	0.423	0.524	0.594	0.647
# Manual	0.453	0.554	0.624	0.675

Count in EGP Composite Class Group	Size of Composite Class Group in PG 8	10	12	14
# Service	0.672	0.719	0.755	0.782
# Nonservice	0.585	0.638	0.679	0.712

Table 6: Projecting Reliabilities of Measures from Those Based on 15-Item PGs

Formula (9) also predicts the median reliabilities of the score-based measures for shorter PGs from the respective 15-occupation medians reasonably well, though not as closely as it does for extensity. We hence used it to forecast reliability levels for longer instruments. These are displayed in Table 6; some caution about interpreting them is warranted. None of the projected values exceeds 0.70, other than those for the two pcs measures in 30-occupation instruments. Relatively long occupational lists appear necessary if these measures are to be resilient to reasonable variations in occupational selection.

Our projected reliability levels based on 25-occupation PGs for these measures are appreciably higher than those that Verhaeghe et al. (2013) report (see Table 2) for their pair of 24-occupation PGs. Differences are particularly marked (above 0.20) for the two average score measures; Verhaeghe et al. (2013) gave reliabilities of 0.362 (ISEI) and 0.317 (prestige) for these. The only exception is for the maximum ISEI measure, for which the Verhaeghe et al. (2013) correlation (0.574) exceeds our projection (0.540).

For the EGP class composition measures, we made projections from the average subscale lengths in our study[23] to a range of subscale lengths that PG designers might reasonably consider when constructing instruments. These projections assume agreement levels in knowing the occupations in a class grouping that

[23]These are given in section 6 above.

are comparable to those in the SSND. The projections indicate that adequately reliable counts for the higher service grouping can be obtained by including 8 occupations from that grouping. More occupations would be necessary for the other three groupings, because agreement levels for them are lower (see Figure 1). For the composite service group, a subscale of length 10 appears sufficient, but more would be needed in the nonservice group. Nonetheless, the reliability of these composition measures appears to be better than that of the maximum or average score-based ones.

At comparable subscale lengths, our projected reliabilities exceed those reported in the Verhaeghe et al. (2013) study. The count for the higher service EGP grouping, for which the two are more or less equal, is the sole exception.

8. Summary and Discussion

This study investigated how varying the occupations presented by a position generator (PG) instrument affects the reliability of commonly-used egocentric network measures based on PG data. We modified the split-half design employed by the Verhaeghe et al. (2013) study of university students for use with already-existing PG data on a national adult population. We replicated and then extended that study, examining how other features of PG instruments — including the relational criterion that links an individual to an occupation and the number of occupations contained in an instrument — affect PG measure reliability.

Our principal findings are

1. For 15-occupation PGs like those often used in substantive studies, most PG measures appear relatively sensitive to occupational selection — that is, only modestly reliable. Only extensity (the number of occupations in which someone has an acquaintance) has a reliability above the conventional standard of adequacy, 0.70.
2. Our assessment of the relative reliability of PG measures corroborates that of Verhaeghe et al. (2013): Extensity is most reliable, composition measures based on EGP class groupings are next, and measures that involve functions (maxima, ranges or averages) of socioeconomic standing or prestige scores are least reliable.
3. Taking PG length into account (see point 6), our findings yield a somewhat more optimistic absolute assessment of PG measure reliability — often by a margin of 0.10 or more — than those presented by Verhaeghe et al. (2013).
4. PG measures that deem a person to be connected to an occupation on the basis of acquaintance with someone who holds it are more reliable than those that require a stronger level of connectivity like friendship or kinship.
5. The reliability of a principal component score summary measure is beneath that of its extensity component alone.
6. The reliability of PG measures rises with PG instrument length (i.e., the number of occupations included).
7. Projections for longer PGs suggest that an instrument with 20 occupations could measure counts of contacts in some EGP class groupings with adequate reliability; this depends, however, on the allocation of occupations to those groupings. Other EGP measures and all measures that depend on socioeconomic or prestige scores would require that 30 or more occupations be included.

These findings hold implications for both analysts who use PG data and designers who develop PG instruments. These are, of course, based on reliability alone, and we recognize that evidence for the validity of measures together with other considerations also may be pertinent.[24] Reliability is, however, a key standard of measurement quality and hence merits consideration.

[24]The study by Hällsten et al. (2015) bears to some extent on validity, since it focuses on associations of measures with outcome criteria. Its central concern is less with specific PG measures than with assessing the impact of including or excluding specific occupations from a PG measure on those associations.

For researchers who use PG data, the assessments here (point 2 above) and in Verhaeghe et al. (2013) suggest that network composition measures based on counts of a respondent's contacts in discrete occupational groups (e.g. the EGP class groupings studied here or others like the higher, medium, and lower status ones used by Otero et al., 2023) may be preferable to those like the average or maximum social standing of the occupations with which someone is in contact. Values of the latter fluctuate quite markedly across different occupational sets.

When constructing new PG instruments, researchers should consider our findings about the relative reliability of different measures (point 2) and how that varies with the number of occupations in a PG (point 6). Decisions about the number of occupations must of course balance numerous considerations including the allocation of limited survey space/time across topics. Considerations of reliability alone, however, would recommend PGs that consist of 20 or more occupations overall, depending on the measures that a study aspires to use. Studies that plan to utilize composition measures involving contacts within discrete occupational groups should be attentive to how occupations are distributed across the groups of interest; including a small number of occupations from a group compromises the reliability of such a measure for that group (see, e.g., our results in Table 2 for the lower service EGP grouping).

We next remark on differences between our results and those reported by Verhaeghe et al. (2013), particularly regarding absolute reliability levels (point 3). Several distinctions between the two studies — including survey mode, the specific wordings of their PG instruments, and their study populations — could underlie these differences, but we are inclined to attribute many of them to the latter source. The Verhaeghe et al. (2013) university student population exhibits limited variation in education and age, both of which are well-established correlates of egocentric network size, socioeconomic composition, and range (Campbell et al., 1986; Otero et al., 2023; Van Tubergen and Volker, 2014). Limiting variation in either should reduce the between-respondent variance σ_r^2 in the ICC in equation (8); unless the other sources combined into σ_{rf}^2 decrease proportionately, reliability should decline. We investigated this prospect by repeating our analyses for 15-occupation PGs after selecting the 600 SSND respondents who hold some post-secondary educational degree. As anticipated, all median reliabilities for this subsample are somewhat smaller than the respective ones in Table 2.[25] This illustrates the value of basing reliability assessments on a broadly-defined study population.

Beyond its findings about PG instruments and measures per se, our analyses make some more general contributions to research about reliability. While internal consistency measures like Cronbach's α assess reliability directly for additive multiple-item scales, the split-half design is useful when studying indices that do not take an additive form, as is so for many PG measures. Nonetheless, a single partition of the items yields only one of many possible reliability values. Our analyses surmount this limitation by constructing a distribution of reliability values for all feasible partitions of the scale items (here, occupations) into replicate pairs or triples.[26] We see in Table 2 and the Supplementary Material that ICC values for most PG measures are well-concentrated near the center of their distributions, but their ranges are nonneglible and vary notably across measures. We are not aware of other studies that document the variation inherent in the split-half design as we do here.

Our study has limitations that should be kept in mind when interpreting and generalizing from its findings. Like all reliability studies, its results are specific to the study population considered. As discussed, the Dutch adult population targeted by the SSND is broadly defined, but it is possible that findings for similarly defined populations in other societies could be different. In particular, societal differences in the density of contact with occupations or in the segmentation of social contacts by status or class groupings could be consequential for reliability; either could affect the level of agreement about contact with different occupations (Table 1 and Figure 1). Data in Otero et al. (2023) suggest that density of contact may well differ across societies,

[25] A full summary of these results can be found in the Supplementary Material.

[26] Obtaining all possible values entails very considerable computational effort. We undertook that effort to comprehensively examine the extent of variation among possible partitions of the occupations. For many purposes it would likely be sufficient to enumerate all partitions, draw a reasonably large simple random sample of them, and then calculate measures and reliabilities for the sampled partitions only. This approach may not fully capture the extremes (minimum, maximum) of a distribution, but should yield adequate estimates of its median and IQR.

but a cross-national study of the segregation of friendship contacts by class position (Wright and Cho, 1992) found no significant differences in this respect.[27]

The findings here are, moreover, specific to the particular position generator that appeared in the SSND. The wording of PG instruments varies, and they use different methods of obtaining information for establishing a relational criterion. Studies of distinctly-worded instruments could yield different findings than this one.

Finally, we have concentrated on differences in occupational selection as a source of unreliability here. While we regard this as a pivotal facet of PGs, investigations of other sources of measurement error on responses to position generator instruments are certainly warranted. Little, for example, is known about the reliability of survey responses to individual PG items that ask respondents whether they are acquainted with someone who holds an occupation.

9. Appendix: Rotation Procedure for Forming Replicate Groups of PG Forms

Our analyses require that — given some assignment of occupations to strata — we create replicate groups (pairs or triples) of possible PG forms such that

1. Each possible PG form appears in some replicate group, and
2. The forms in each replicate group are composed of disjoint sets of occupations (so that overlap among occupations does not inflate the correlation among PG measures for the forms in a group).

The "rotation" procedure we describe and illustrate in this appendix achieves these ends simultaneously. A rotation refers to a sequential reordering of the occupations in a stratum. By rotating the occupations in different strata across forms more and less rapidly, we enumerate all possible PG forms and construct groups of them that include distinct occupations.

Consider a two-occupation stratum A that includes occupations O1 and O2. Its simple rotation is

$$\begin{bmatrix} \text{O1} & \text{O2} \end{bmatrix} \rightarrow \begin{bmatrix} \text{O2} & \text{O1} \end{bmatrix}.$$

The ordering of occupations within the brackets indicates which occupation in the stratum is assigned to form 1 and which to form 2 in a replicate pair.

With two additional strata B and C composed of occupations (O3, O4) and (O5, O6), we can construct four replicate pairs of 3-occupation PGs:

$$\begin{bmatrix} \text{O1} & \text{O2} \\ \text{O3} & \text{O4} \\ \text{O5} & \text{O6} \end{bmatrix} \begin{bmatrix} \text{O1} & \text{O2} \\ \text{O3} & \text{O4} \\ \text{O6} & \text{O5} \end{bmatrix} \begin{bmatrix} \text{O1} & \text{O2} \\ \text{O4} & \text{O3} \\ \text{O5} & \text{O6} \end{bmatrix} \begin{bmatrix} \text{O1} & \text{O2} \\ \text{O4} & \text{O3} \\ \text{O6} & \text{O5} \end{bmatrix}.$$

The columns here give the eight PGs possible given these strata; brackets indicate how they are grouped into replicate pairs. The occupations in each pair of forms are distinct. Occupations in the first stratum do not rotate: O1 is always placed in the first PG in a pair, and likewise O2 always appears in the pair's second PG. Occupations O3 and O4 from stratum B rotate slowly, while O5 and O6 (stratum C) rotate rapidly.

When studying PG forms with between 11 and 14 occupations, we again construct replicate pairs, in order to satisfy requirement 2 above. This involves a mixture of 2- and 3-occupation strata; we use the same rotation pattern for the 2-occupation strata, but for the 3-occupation ones we rotate all pairs of occupations therein. For a 3-occupation stratum D (O3, O4, O5), we rotate as follows:

[27] Unfortunately, neither of these studies includes the Netherlands.

$$\begin{bmatrix} O3 & O4 \end{bmatrix} \rightarrow \begin{bmatrix} O5 & O3 \end{bmatrix} \rightarrow \begin{bmatrix} O4 & O5 \end{bmatrix}.$$

Note that each occupation appears once together with each other in its stratum, and once each in the first and second position within the rotation.

To assemble replicate pairs, we append each of these pairs from 3-occupation strata to each combination of occupations from 2-occupation strata. With one 2-occupation stratum A (O1, O2) and a second 3-occupation stratum E (O6, O7, O8), this yields these nine $(= (2 * 3 * 3)/2)$ replicate pairs:

$$\begin{bmatrix} O1 & O2 \\ O3 & O4 \\ O6 & O7 \end{bmatrix} \begin{bmatrix} O1 & O2 \\ O3 & O4 \\ O8 & O6 \end{bmatrix} \begin{bmatrix} O1 & O2 \\ O3 & O4 \\ O7 & O8 \end{bmatrix} \begin{bmatrix} O1 & O2 \\ O5 & O3 \\ O6 & O7 \end{bmatrix} \begin{bmatrix} O1 & O2 \\ O5 & O3 \\ O8 & O6 \end{bmatrix} \begin{bmatrix} O1 & O2 \\ O5 & O3 \\ O7 & O8 \end{bmatrix} \begin{bmatrix} O1 & O2 \\ O4 & O5 \\ O6 & O7 \end{bmatrix} \begin{bmatrix} O1 & O2 \\ O4 & O5 \\ O8 & O6 \end{bmatrix} \begin{bmatrix} O1 & O2 \\ O4 & O5 \\ O7 & O8 \end{bmatrix}.$$

The positions of occupations in stratum A are fixed; those in stratum D rotate slowly and those in stratum E rapidly. The nine columns again contain all 18 PGs possible given these strata, and each pair of PGs is composed of different occupations. One occupation from each 3-occupation stratum is necessarily omitted from each PG.

Since the 30 SSND occupations can be divided into three groups of 10 each, for 10-occupation PG forms we construct replicate triples using still another rotation scheme. Here, a 3-occupation stratum F including occupations (O4, O5, O6) is rotated as

$$\begin{bmatrix} O4 & O5 & O6 \end{bmatrix} \rightarrow \begin{bmatrix} O6 & O4 & 05 \end{bmatrix} \rightarrow \begin{bmatrix} O5 & O6 & O4 \end{bmatrix}.$$

.

With three such strata (F, G and H), paralleling the procedure outlined above — fixing the occupations in stratum F, rotating those in stratum G slowly, and those in stratum H rapidly — produces this set of nine replicate triples:

$$\begin{matrix} \begin{bmatrix} O1 & O2 & O3 \\ O4 & O5 & O6 \\ O7 & O8 & O9 \end{bmatrix} & \begin{bmatrix} O1 & O2 & O3 \\ O4 & O5 & O6 \\ O9 & O7 & O8 \end{bmatrix} & \begin{bmatrix} O1 & O2 & O3 \\ O4 & O5 & O6 \\ O8 & O9 & O7 \end{bmatrix} \\ \begin{bmatrix} O1 & O2 & O3 \\ O6 & O4 & O5 \\ O7 & O8 & O9 \end{bmatrix} & \begin{bmatrix} O1 & O2 & O3 \\ O6 & O4 & O5 \\ O9 & O7 & O8 \end{bmatrix} & \begin{bmatrix} O1 & O2 & O3 \\ O6 & O4 & O5 \\ O8 & O9 & O7 \end{bmatrix} \\ \begin{bmatrix} O1 & O2 & O3 \\ O5 & O6 & O4 \\ O7 & O8 & O9 \end{bmatrix} & \begin{bmatrix} O1 & O2 & O3 \\ O5 & O6 & O4 \\ O9 & O7 & O8 \end{bmatrix} & \begin{bmatrix} O1 & O2 & O3 \\ O5 & O6 & O4 \\ O8 & O9 & O7 \end{bmatrix} \end{matrix}.$$

These triples satisfy the above conditions: All 27 PG forms possible given the allocation of occupations to strata appear in one triple, and no triple includes an occupation more than once.

The grouping of PG forms into replicate pairs shown is unique when only 2-occupation strata exist. When 3-occupation strata are present, it is not. For example, another rotation of occupations in the third stratum (H) above also enumerates all 27 possible 3-occupation PGs, but it yields a different set of replicate triples:

$$\begin{bmatrix} O7 & O9 & O8 \end{bmatrix} \rightarrow \begin{bmatrix} O8 & O7 & O9 \end{bmatrix} \rightarrow \begin{bmatrix} O9 & O8 & O7 \end{bmatrix},$$

For three 3-occupation strata, there are 40 distinct ways of forming replicate triples that meet the two conditions above. With the ten strata in our analyses involving 10-occupation PGs, many more possible arrangements than that exist.

With a mixture of 2- and 3-occupation strata, multiple sets of replicate pairs of PGs also exist. While the results we present in section 7.3 are based only one of those, we know of no reason that would make PG measures based on its set of replicate groups of PGs notably more or less consistent with one another than any other set that can be devised.

10. Supplementary Material

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Maximum	ISEI	0.363	0.400	0.410	0.410	0.419	0.455
	S&U Prestige	0.357	0.411	0.425	0.424	0.437	0.477
Range	ISEI	0.345	0.401	0.416	0.416	0.431	0.484
	S&U Prestige	0.339	0.396	0.410	0.410	0.425	0.475
Average	ISEI	0.353	0.422	0.437	0.438	0.453	0.509
	S&U Prestige	0.340	0.420	0.437	0.437	0.455	0.517
PCS	ISEI	0.495	0.546	0.558	0.558	0.570	0.612
	S&U Prestige	0.502	0.560	0.573	0.573	0.586	0.629

Note: Distribution based on 16,384 replicate pairs.

Table S1: Full Range of Reliability Values for Measures Based on 15-item PGs: Equated ISEI/Prestige Scores Within Strata

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Extensity		0.470	0.529	0.545	0.545	0.560	0.622
Maximum	ISEI	0.214	0.269	0.285	0.286	0.304	0.360
	S&U Prestige	0.210	0.262	0.279	0.281	0.298	0.369
Range	ISEI	0.190	0.263	0.280	0.280	0.297	0.362
	S&U Prestige	0.205	0.275	0.290	0.289	0.304	0.358
Average	ISEI	0.265	0.335	0.353	0.354	0.372	0.436
	S&U Prestige	0.256	0.318	0.337	0.337	0.356	0.436
PCS	ISEI	0.294	0.372	0.388	0.388	0.404	0.466
	S&U Prestige	0.309	0.380	0.396	0.396	0.412	0.472
Counts in EGP Class Groups							
# Service		0.400	0.420	0.436	0.443	0.475	0.494
# Nonservice		0.359	0.424	0.442	0.441	0.458	0.511
# Higher Service		0.281	0.309	0.316	0.320	0.338	0.354
# Lower Service		0.137	0.141	0.174	0.176	0.209	0.216
# Intermediate		0.224	0.244	0.265	0.260	0.278	0.294
# Manual		0.287	0.310	0.337	0.333	0.354	0.370

Note: Distribution based on 16,384 replicate pairs.

Table S2: Full Range of Reliability Values for Measures Based on 15-item PGs: Relative Relationship Criterion

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Extensity		0.452	0.527	0.544	0.544	0.561	0.634
Maximum	ISEI	0.275	0.333	0.347	0.347	0.362	0.411
	S&U Prestige	0.255	0.305	0.318	0.319	0.332	0.399
Range	ISEI	0.181	0.252	0.270	0.270	0.288	0.350
	S&U Prestige	0.206	0.264	0.278	0.277	0.291	0.337
Average	ISEI	0.284	0.392	0.412	0.410	0.431	0.503
	S&U Prestige	0.274	0.375	0.395	0.394	0.413	0.491
PCS	ISEI	0.341	0.406	0.421	0.421	0.438	0.494
	S&U Prestige	0.332	0.406	0.422	0.421	0.436	0.495
Counts in EGP Class Groups							
# Service		0.444	0.460	0.493	0.490	0.517	0.543
# Nonservice		0.377	0.449	0.465	0.464	0.481	0.534
# Higher Service		0.386	0.391	0.395	0.404	0.410	0.439
# Lower Service		0.071	0.125	0.152	0.148	0.175	0.216
# Intermediate		0.250	0.295	0.301	0.299	0.313	0.330
# Manual		0.297	0.342	0.359	0.353	0.372	0.386

Note: Distribution based on 16,384 replicate pairs.

Table S3: Full Range of Reliability Values for Measures Based on 15-item PGs: Friend Relationship Criterion

2-Occupation Stratum	Occupation	Jaccard Coefficient (Acq.)	Jaccard Coefficient (Friend)	Jaccard Coefficient (Relative)
A	Doctor Lawyer	0.488	0.346	0.231
B	Scientist Policymaker	0.423	0.296	0.168
C	Information technologist Director of a company	0.600	0.390	0.233
D	Engineer Manager	0.566	0.423	0.291
E	Teacher Trade union manager	0.165	0.059	0.036
F	Higher civil servant Nurse	0.502	0.290	0.213
G	Estate agent Insurance agent	0.350	0.168	0.128
H	Secretary Bookkeeper/accountant	0.552	0.316	0.209
I	Sales employee Hairdresser	0.479	0.248	0.144
J	Farmer Musician/artist/writer	0.396	0.213	0.120
K	Police officer Foreman	0.236	0.133	0.076
L	Mechanic Engine driver	0.206	0.131	0.094
M	Postman Truck driver	0.306	0.128	0.080
N	Cook Cleaner	0.322	0.145	0.103
O	Unskilled laborer Construction worker	0.417	0.274	0.213

Table S4: Jaccard Cofficients by Relationship Criterion

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Extensity		0.619	0.680	0.692	0.692	0.704	0.753
Maximum	ISEI	0.185	0.387	0.404	0.392	0.417	0.474
	S&U Prestige	0.144	0.356	0.379	0.375	0.400	0.472
Range	ISEI	0.227	0.358	0.384	0.380	0.405	0.482
	S&U Prestige	0.259	0.356	0.376	0.375	0.396	0.471
Average	ISEI	0.292	0.421	0.444	0.442	0.464	0.548
	S&U Prestige	0.214	0.390	0.414	0.411	0.436	0.525
PCS	ISEI	0.434	0.530	0.546	0.545	0.561	0.616
	S&U Prestige	0.448	0.529	0.543	0.543	0.558	0.612
Counts in EGP Class Groups							
# Service		0.491	0.564	0.594	0.586	0.614	0.637
# Nonservice		0.499	0.580	0.598	0.596	0.614	0.656
# Higher Service		0.386	0.502	0.516	0.498	0.528	0.531
# Lower Service		0.070	0.185	0.265	0.246	0.269	0.321
# Intermediate		0.309	0.438	0.464	0.454	0.481	0.520
# Manual		0.292	0.402	0.447	0.431	0.462	0.489

Note: Distribution based on 92,160 replicate pairs.

Table S5: Full Range of Reliability Values for Measures Based on 14-item PGs

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Extensity		0.581	0.663	0.676	0.676	0.689	0.748
Maximum	ISEI	0.163	0.346	0.392	0.373	0.410	0.477
	S&U Prestige	0.119	0.333	0.365	0.358	0.392	0.477
Range	ISEI	0.186	0.339	0.368	0.364	0.393	0.487
	S&U Prestige	0.224	0.343	0.365	0.363	0.385	0.476
Average	ISEI	0.229	0.397	0.424	0.421	0.447	0.543
	S&U Prestige	0.159	0.363	0.393	0.389	0.419	0.517
PCS	ISEI	0.416	0.512	0.532	0.530	0.550	0.613
	S&U Prestige	0.421	0.512	0.529	0.528	0.545	0.609
Counts in EGP Class Groups							
# Service		0.441	0.541	0.567	0.567	0.602	0.637
# Nonservice		0.434	0.557	0.580	0.577	0.600	0.656
# Higher Service		0.341	0.425	0.502	0.476	0.518	0.531
# Lower Service		0.070	0.185	0.265	0.232	0.269	0.321
# Intermediate		0.266	0.396	0.441	0.433	0.476	0.520
# Manual		0.261	0.378	0.414	0.410	0.453	0.489

Note: Distribution based on 207,360 replicate pairs.

Table S6: Full Range of Reliability Values for Measures Based on 13-item PGs

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Extensity		0.551	0.645	0.658	0.658	0.671	0.737
Maximum	ISEI	0.142	0.308	0.373	0.354	0.400	0.470
	S&U Prestige	0.086	0.307	0.347	0.340	0.379	0.477
Range	ISEI	0.169	0.321	0.352	0.349	0.380	0.478
	S&U Prestige	0.190	0.330	0.352	0.350	0.373	0.471
Average	ISEI	0.195	0.374	0.403	0.399	0.428	0.537
	S&U Prestige	0.108	0.338	0.371	0.366	0.400	0.507
PCS	ISEI	0.391	0.494	0.516	0.514	0.535	0.608
	S&U Prestige	0.384	0.495	0.513	0.512	0.531	0.604
Counts in EGP Class Groups							
# Service		0.441	0.518	0.551	0.547	0.580	0.637
# Nonservice		0.419	0.534	0.559	0.557	0.582	0.656
# Higher Service		0.341	0.413	0.433	0.453	0.514	0.531
# Lower Service		0.070	0.140	0.248	0.218	0.269	0.321
# Intermediate		0.266	0.371	0.414	0.411	0.453	0.520
# Manual		0.261	0.343	0.399	0.388	0.438	0.489

Note: Distribution based on 233,280 replicate pairs.

Table S7: Full Range of Reliability Values for Measures Based on 12-item PGs

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Extensity		0.527	0.624	0.638	0.637	0.652	0.720
Maximum	ISEI	0.140	0.288	0.344	0.335	0.386	0.468
	S&U Prestige	0.081	0.283	0.326	0.320	0.363	0.481
Range	ISEI	0.162	0.305	0.336	0.334	0.365	0.472
	S&U Prestige	0.190	0.315	0.340	0.337	0.361	0.455
Average	ISEI	0.182	0.350	0.380	0.377	0.407	0.523
	S&U Prestige	0.095	0.314	0.349	0.344	0.379	0.484
PCS	ISEI	0.354	0.475	0.498	0.496	0.518	0.591
	S&U Prestige	0.368	0.476	0.495	0.494	0.514	0.595
Counts in EGP Class Groups							
# Service		0.441	0.499	0.526	0.526	0.555	0.631
# Nonservice		0.419	0.510	0.536	0.534	0.560	0.626
# Higher Service		0.341	0.406	0.422	0.431	0.435	0.531
# Lower Service		0.070	0.096	0.235	0.204	0.269	0.321
# Intermediate		0.266	0.352	0.383	0.388	0.428	0.520
# Manual		0.261	0.320	0.362	0.365	0.405	0.480

Note: Distribution based on 131,220 replicate pairs.

Table S8: Full Range of Reliability Values for Measures Based on 11-item PGs

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Extensity		0.558	0.605	0.614	0.614	0.623	0.660
Maximum	ISEI	0.234	0.299	0.314	0.313	0.328	0.390
	S&U Prestige	0.179	0.272	0.299	0.293	0.318	0.375
Range	ISEI	0.215	0.293	0.308	0.308	0.323	0.387
	S&U Prestige	0.231	0.296	0.312	0.312	0.328	0.382
Average	ISEI	0.256	0.341	0.359	0.357	0.375	0.427
	S&U Prestige	0.206	0.305	0.325	0.322	0.342	0.392
PCS	ISEI	0.397	0.453	0.465	0.464	0.476	0.525
	S&U Prestige	0.394	0.451	0.463	0.463	0.475	0.513
Counts in EGP Class Groups							
# Service		0.480	0.498	0.504	0.505	0.515	0.526
# Nonservice		0.456	0.501	0.510	0.510	0.522	0.551
# Higher Service		0.398	0.405	0.407	0.409	0.415	0.419
# Lower Service		0.185	0.185	0.196	0.204	0.232	0.232
# Intermediate		0.339	0.353	0.363	0.365	0.380	0.403
# Manual		0.321	0.331	0.340	0.343	0.357	0.367

Note: Distribution based on 19,683 replicate pairs.

Table S9: Full Range of Reliability Values for Measures Based on 10-item PGs

PG Measure	Occupation Score	Min.	Q1	Median	Mean	Q3	Max.
Extensity		0.605	0.664	0.678	0.678	0.692	0.748
Maximum	ISEI	0.323	0.378	0.389	0.388	0.400	0.427
	S&U Prestige	0.271	0.344	0.365	0.362	0.382	0.433
Range	ISEI	0.249	0.338	0.360	0.360	0.382	0.470
	S&U Prestige	0.258	0.343	0.362	0.363	0.383	0.465
Average	ISEI	0.326	0.421	0.446	0.446	0.470	0.565
	S&U Prestige	0.285	0.393	0.418	0.417	0.442	0.530
PCS	ISEI	0.441	0.510	0.527	0.528	0.545	0.613
	S&U Prestige	0.453	0.517	0.533	0.533	0.549	0.615
Counts in EGP Class Groups							
# Service		0.487	0.544	0.561	0.558	0.577	0.605
# Nonservice		0.552	0.588	0.605	0.604	0.621	0.662
# Higher Service		0.461	0.473	0.483	0.484	0.495	0.512
# Lower Service		0.162	0.174	0.204	0.211	0.241	0.276
# Intermediate		0.419	0.449	0.456	0.460	0.475	0.502
# Manual		0.400	0.439	0.458	0.456	0.475	0.508

Note: Distribution based on 16,384 replicate pairs.

Table S10: Full Range of Reliability Values for Measures Based on 15-item PGs: Sample Restricted to College-Educated Individuals

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