An International Survey of Practitioners' Views on Personas:

Benefits, Resource Demands and Pitfalls

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Abstract— **Opinions differ on the relative costs and benefits of personas as used in Interaction design (IxD) and User Experience (UX). And yet there has been little research to systematically elicit attitudes towards them held by IxD and UX professionals. We report a 'state-of-practice' survey conducted with IxD/UX professionals called 'What's Hot in Interaction Design' and focus here on 20 items from the survey that elicited usage of and opinions about personas. The survey items were derived from opinions and reports collated from the academic and professional literature. We use factor analysis to reduce the items to a fundamental set of areas or concerns (factors), and use significance testing to test for agreement on each item including an analysis of the strength of opinion using odds ratio. According to the findings, 64% of respondents use personas with usage during research, design & evaluation phases. The factor analysis shows that opinions fall into three broad areas: benefits, resource demands, and pitfalls. Practitioners tend to agree that personas have a range of benefits, but that they make demands on specific kinds of resources and there are some specific pitfalls—all of which we report. We discuss implications for improving personas through enhanced methods and tools, and curricula.**

Keywords-persona usage; persona factors; prioritising persona attitudes; interaction design; theory and practice; tools and curricula.

I. INTRODUCTION

This paper presents findings from a survey of Interaction Design (IxD) and User Experience (UX) professionals concerning their views about personas, presented initially in [1] and extended using exploratory factor analysis, which reveals three factors: benefits, resource demands and pitfalls. In 1999, Cooper [2] introduced the idea of personas as a way of anchoring design within a vision of intended users. A persona is a kind of user-model—a *composite archetype* [3] drawn from behavioral data from users of an existing or intended digital product. A set of personas can be created where each represents a group of users with similar behaviors, attitudes, aptitudes, and needs. Methods for creating personas have been suggested by Cooper [3], Pruitt and Adlin [4], and Nielsen [4][5] with semi-automated methods also being proposed [7]–[9].

Personas can have a role in the three phases of the User Centered Design (UCD): User Research & Requirements, Designing & Prototyping and Evaluation. Advocates argue that they promote empathy and help focus design on the goals and characteristics of users. Despite the enthusiasm that some hold for personas, however, concerns have been raised about issues such as the resources required to create them [4][10]–[13] and their value to the design process [12]–[16].

A review of practitioners' attitudes towards personas via a selection of articles on professional websites revealed views ranging from strong advocacy to skepticism. Although it has been 18 years since the publication of The Inmates are Running the Asylum [2], there has been little research to systematically elicit attitudes towards personas held by the people who might use them—Interaction Design and User Experience professionals.

We conducted an online survey called 'What's Hot in Interaction Design' to elicit details of current practices and attitudes of industry professionals. The survey spanned many topics, of which personas was one. Our motivation was to provide stimulus for considering new methods and tools, to inform university syllabus development, and simply to record and report current trends. The survey was in two parts: (1) an initial part about Interaction Design/User Experience practice in general ('main survey'), which included 4 questions about personas, and (2) an optional additional part ('persona survey'), with 16 items (hereafter referred to as 'A1' to 'A16' see Table I) focused on personas. Items were derived from a review of issues raised in the academic literature. The main survey was completed by 173 practitioners. 76 practitioners went on to complete the persona survey.

In this paper, we report results relating to persona use from both the main survey and the persona survey. We also report an exploratory factor analysis that was used to organize the results in terms of a set of more abstract, latent variables. This provides an organizing principle for attitudes towards personas reducing them into to a set of more fundamental factors. We also report an analysis of each item using significance testing and prioritize items using effect size (odds ratio) as a measure of relative strength of feeling.

In Section II, we review background literature that provided the basis for the persona survey items. In Section III, we discuss the survey and analysis method, and in Section IV we report the findings. In the final section, we summarize the results and discuss implications of our findings for interaction design practice.

II. LITERATURE REVIEW

A. Overview on Personas

Cooper introduced the idea of personas in 1999 [2]. Although a method for creating personas was not clearly

articulated at that point, the idea attracted a good deal of attention. According to Cooper, personas offer a balance between formality and informality that carries more nuance than diagrammatic models through capturing users' goals, tasks, characteristics, and environments. The belief was that they could allow design teams from different disciplines and stakeholders to communicate about and empathize with the users and develop more focused designs. Methods for creating personas were subsequently offered that provided a structured approached to the development of personas. These included Pruitt, Grudin and Adlins' 'role-based perspective' [4][10]; Cooper, Reimann and Cronin's 'goal-directed perspective' [2]; and Nielsen's 'engaging perspective' [5]. Cooper, Reimann and Cronins' [2] method is a 7-step approach representing user-goals and including activities, attitudes, aptitudes, motivations, and skills towards a product. Pruitt, Grudin, and Adlin [4][10] agreed on the benefits of personas suggested earlier, but proposed personas as a complementary tool. Their method is a 5-step approach that looks into massive data and attempts to verify the quality and adequacy of persona representation. Nielsen [4][5], who observed variations in persona use, criticized some practitioners for failing to fully appreciate the potential of personas and for adopting marketing archetypes as personas. She offered the 'Engaging Persona' process, which is a 10-step approach aimed at establishing common ground on gathering data related to user needs, attitudes and aptitudes and includes details such as social background, psychological characteristics, and emotional relationship to invoke empathy and avoid stereotyping [17]. The method also included some steps that focus on how to make personas accepted and used by team members.

B. Studies on Personas

Some studies have explored experiences and outcomes of persona creation and use. Blomquist and Arvola [14], for example, observed a design team's first experience with personas. Methods for creating personas were relatively under-developed at that time and the authors found designers lacked confidence in using them for communication or design, concluding a need for expertise and integrating personas within existing knowledge and practice. Chang *et al.* [18] reported a small study with practitioners comparing attitudes of some who used personas and some of who didn't. The study found more positive attitudes towards personas from those who use personas who found it an essential tool for design. The study also found practitioners experimenting with new approaches. Later, Miaskiewicz and Kozar [19] elicited perceived benefits of personas from 19 experts (practitioners who created and used them) and derived a ranked list of 22 benefits, including: providing audience focus, helping to guide decisions, supporting collaboration, acting as a communication aid and guiding evaluation. Mathews *et al.* [16] reported a study of 14 practitioners and observed that those trained on Cooper's method tended to champion personas, whereas those trained in Engineering and Computer Science were 'moderate' persona users, and those trained in HCI and Design were pessimistic. The study also indicated benefits of personas in helping understand users' needs and context and establishing common ground.

A number of literature sources draw attention to the cost implications of personas creation. LeRouge [20] argued that despite their cost implications, when personas are successfully integrated into a design process by trained team members, the benefits outweigh the costs. Billestrup *et al.* [21] designed a questionnaire survey to investigate the knowledge and use of personas across 60 software development companies within a specific geographical region. The results revealed that more than half of the respondents had not heard of personas while the other respondents stated that personas were not well integrated into the development process. In addition, some problems related to time and budget constraints, limited knowledge with persona methods and inadequacy/ shallowness of persona descriptions were reported.

Based on an observational study of design team conversations, Friess [12] questioned the benefits of personas as a tool for communication. Fries' study showed that despite time and resources spent on developing and refining personas, they were only referred to briefly in designers' conversations. Fries, however, resists the conclusion that personas are not useful with the observation that members of the design team who created personas invoked them in conversations much more often than other team members and stakeholders. Tharon [13] commented on the result that, "Leaving the development of the personas to a select few on the team seems likely to ensure that those few are the only members of your team who will benefit from the time and money invested in the personas development."

C. Personas and Empirical Methods of User Research

It is argued across the several methods of creating personas [3]–[5][7]–[9][11] that personas should be derived from user research. The approach suggested by Cooper [2][3] was solely qualitative, involving informal manual clustering of users (based on 'behavioral variables'). Such an approach has raised questions about possibilities of exploiting quantitative data [4][9]–[11], as well as issues of sample size [4][7][9]–[11][15], adequacy of personas in terms of validity and human bias [8][9][11][15], and time and budget implications [4][7][9]–[11][13][15][16][22]. In response to such issues, some have proposed the integration of quantitative research and/or automating clustering methods.

Pruitt, Adlin, and Grudin [4][10] were the first to combine quantitative and qualitative methods based on existing data about users. Their clustering method remained manual and was performed by experts in user research. They suggested validating personas through "sanity checks" and "foundation documents" to link them with the original gathered data. Later, Chapman's and Milham's [15] discussed the unexplored limitations of the former persona methods in terms of significance, accuracy, validity, human bias, and relation to the design of the product. These authors focused on bringing some automation to the process to increase objectivity, improve validity by increasing sample size, whilst also improving the efficiency of the method and making it less dependent on research expertise.

Mulder and Yaar [11] proposed a mixed method for web design personas starting with a quantitative analysis of large-scale market research and website log data and using semi-automated clustering techniques to create market segmentation/user profiles, followed by qualitative analysis such as interviews, field studies or usability tests. Following this, McGinn and Kotamraju [9] suggested designing a survey with agreed attributes to collect large-samples of customer data. *Factor Analysis* (FA) was used from the initial groupings, followed by interviews with selected users to reveal the goals and motivation and to validate group membership.

Maikenzie *et al.* [8] proposed *Latent Semantic Analysis* (LSA) for semi-automated clustering of qualitative interview transcripts data, proposing this method to be "more efficient, less subjective, and less reliant on specialized skills". Brikey, Walczak, and Burgess [7] reported a study that classified the methods of creating personas in terms of *manual qualitative techniques and semi-automated techniques (*LSA, FA, principal component analysis (PCA) and multivariate cluster analysis (CA)). The findings indicated that LSA semi-automated method, when compared to the manual qualitative method, is not affected by the quantity of data, requires less expertise in clustering, is faster and cheaper, and minimizes human bias. The study also showed that the three automated clustering techniques didn't agree with the cluster assignment done by experts.

In her 10-step approach, Nielsen [5] applies quantitative and qualitative research methods and considers manual clustering techniques (affinity diagrams and empathy maps) to be performed by qualified team members. These approaches each in its own capacity have exploited at least one of the following: sample size, adequacy of persona, time and budget; yet all of them need the expertise in quantitative/qualitative data analysis for clustering users.

D. Professional Literature

We also conducted a review of professional magazines and association websites for articles on personas. Here, mixed opinions can be found along with specific concerns that in many cases echo those expressed in the academic literature. For example, Sholmo [23][24] remarks, "For every designer who uses personas, I have found even more who strongly oppose the technique." He reflects on his own conversion from negative attitude to positive once he started to develop and use personas "properly" in his work. He attempts to convince detractors to change their perceptions and promotes the use of personas for those who are unfamiliar with the process. Similarly Kellingley [25], another advocate for the development of personas, agreed with many of the criticisms under three headings: "Personas are time-consuming", "Personas are expensive", and "Personas need time to show ROI". However, he argues that more time and money would be spent on building and rebuilding products without considering user requirements and personas. Accordingly, the attempt to reduce cost and time by cutting back on user research and abandoning the use of personas does not hold. In the same way, Bryan [26] discusses three reasons that lead some peers to adverse personas as a design tool. First, the use of "Analytics", which he argues can reveal many insights about the design components based on users' interactions, overlooks how UX designers work and merely specifies user behaviors, which is essential to the UX strategy. Second, A/B and multivariate testing assesses alternative designs in terms of quantitative results, but do not suggest how to reach the best design. Third, in an agile environment UX practitioners feel a burden when creating and designing personas because of time constraints, which again reveals that there is a need for better ways of fitting personas in the UX process.

III. METHOD

A. Survey Design

The main survey contained 29 questions distributed across sections on: (1) demographics; (2) user research; (3) design and prototyping; (4) product development; and (5) evaluation. Section (1) contained questions about respondents' professional experience, the answers to which determined subsequent sections they were asked to complete. There were four questions about personas in the main survey across the remaining sections.

The persona survey contained 16 items. Each elicited agreement with a series of propositions on a five-point Likert scale. Each proposition represents a possible attitude towards personas. These were derived from the literature by collating opinions and making observations of work reported by relevant academic sources (most appear in the literature review above) and a selection of industry blogs. The propositions are itemized in Table I and each is mapped against its sources.

The studies we used to generate the propositions were typically qualitative and/or longitudinal and based on a small sample drawn from a specific context. In this sense, the survey can be seen as corroborating their findings against a larger and more widely drawn sample. In some cases, sources contradicted each other. Here the survey can be seen as helping to resolve such conflicts. Thus, we believed we converged on a set of concerns that were relevant and might be profitably tested with reference to the experience of a larger sample of practitioners.

It is not uncommon for surveys to use both forward and reverse-keyed versions of items to control for possible acquiescence bias. However, Sonderen *et al.* [28] and Schriesheim & Hill [29] argue that there is little empirical evidence to support this recommendation and demonstrate that it can increase respondent confusion and introduce difficulties in interpretation. Since reverse-keying effectively doubles the size of a survey, which would have a negatively effect on sample size, it was not used here. Hence, we opted for one item per proposition.

B. Participants and recruitment

The target population for the survey was UX/IxD practitioners. Respondents were recruited by non-probabilistic convenience sampling via invitations to online interest groups, and by snowball sampling via the researchers' professional networks. The requirement of working as a UX/IxD practitioner was included in invitations. Respondents

were asked to give job titles as part of the survey and these were subsequently reviewed for relevance prior to analysis.

TABLE I. THE 16 STATEMENTS USED AS ATTITUDINAL MEASURES TOWARDS PERSONAS. (SUPPORTIVE/UN-SUPPORTIVE INDICATES OPINION ELICITIED FROM OR OBSERVATION MADE OF REPORTED WORK)

A1: Personas are time consuming to create/use. **Supportive:** [4][9]–[11][13][20][21]. **Unsupportive:** [7][8]
A2: Personas are expensive to create/use. **Supportive:** [4][9]–[11][20][21] **Unsupportive:** [7][8]
A3: Representative personas require a lot of data. **Supportive** [4][9]–[11][20]. **Unsupportive:** [18][27]
A4: Personas require expertise in qualitative research to create. **Supportive:** [3][4][10][11][14][18][20]. **Unsupportive:** [7][8]
A5: Personas require training in persona methods. **Supportive:** [3]–[5][9]–[11][16][20]
A6: Collaborating around personas is difficult. **Supportive:** [4][10][14]. **Unsupportive:** [15]
A7: Personas are often not properly used by teams. **Supportive:** [12][13]. **Unsupportive:** [4][8][14]
A8: Personas often represent extreme archetypes **Supportive:** [3][11][22]
A9: Personas often lack important information related to goals, needs, behaviors, and attitudes. **Supportive:** [21]. **Unsupportive:** [2]–[6][10][11]
A10: Persona sets often incorporate redundancy (multiple personas referring to the same characteristics). **Supportive:** [3][4]
A11: Personas are helpful for understanding users' needs and context. **Supportive:** [2]–[7][10][11][20][22]. **Unsupportive:** [14]
A12: Personas are helpful for making design decisions. **Supportive:** [3][4][6][8][10][11][22]. **Unsupportive:** [14]–[16]
A13: Personas are helpful for implementing and building **Supportive:** [3][4][6][10][11][20][22]
A14: Personas are helpful for evaluation. **Supportive:** [11][19][20][22]. **Unsupportive:** [21]
A15: Personas are helpful for communicating with stakeholders and team members. **Supportive:** [2]–[6][8][10][11][20][22]. **Unsupportive:** [12]–[14]
A16: The personas I use are usually well formed and adequate. **Unsupportive:** [21]

C. Data Analysis

Responses to each Likert item were coded on a scale of 1 to 5 where 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*. For each item, a lower bound one-sample, one-tailed sign test was performed to assess agreement according to the following hypotheses:

H0: The population median response is equal to or less than 'neutral' ($\eta <= 3$) (i.e., non-agreement)

H1: The population median response is greater than 'neutral' ($\eta > 3$) (i.e., agreement)

Given the multiple tests, Benjamini and Hochberg [30] was used to control for inflated type I error rate ($\alpha_{adjusted} = .040625$). The odds ratio (OR) (an unstandardized effect size statistic) was also computed for each item and used to organize the responses in terms of strength of expressed opinion.

IV. FINDINGS

A. Demographics

The main survey and the persona survey were completed by 173 and 76 practitioners respectively, with the following self-reported demographics (number in main survey/number in persona survey):

- Job Titles: UX Designers (52/21), UX Researchers (27/13), Senior User Experience Designers (23/13), User Interface Designer / Information Architect (7/2), and others (64/27);
- Years of experience: > 5 yrs (79/36), 3 to 5 yrs(45/17), 1 to 2 yrs (26/11), < 1 year (23/12);
- Countries: UK (56/30), USA (35/13), Sweden (12/7), India (11/2), Norway (8/3), UAE (8/3) and 43/18 others;
- Organization size: 20-99 employees (34/14), 1000-4999 employees (31/13), 10000+ employees (24/13), 100 to 499 employees (24/6), 5000-9999 employees (20/8), 1 to 4 employees (12/3), 10 to 19 employees (9/5), 500 to 999 employees (8/8), 5 to 9 employees (6/6).

Respondents worked with digital products in the areas: websites (134/63); mobile solutions/applications (121/52); consumer technology (73/35); enterprise solutions (67/33); accessibility (62/24); visualization of big data (44/25); smart objects/devices (IOT)(31/10); tabletops/multi-touch surfaces (24/8); wearable technology (19/5); Robotics & AI (16/4); A/R (14/3); VR (11/2); others (35/14).

B. Persona Use

Of the 173 practitioners who completed the main survey 111 (64%) reported using personas in some capacity. Of 105 respondents involved in user research, 78 (74%) reported using personas to represent/communicate user needs based on research studies. Of 109 respondents involved in design and prototyping, 69 (63%) reported using personas for motivating design ideas/decisions and 44 (40%) reported using persona-based inspection for creating/refining the concepts of design. Of 113 respondents involved in evaluation, 34 (30%) reported using persona-based inspection methods.

C. Results from the Personas Survey

Of the practitioners who completed the 'What's Hot in Interaction Design?' survey, 76 went on to complete the optional persona survey.

1) Exploratory Factor Analysis

We wanted to understand the results of the persona survey in terms of a reduced set of underlying factors to use as an organizing principle for attitudes towards personas.

TABLE II. FACTOR LOADINGS AND COMMUNALITIES BASED ON A PAF WITH OBLIMIN ROTATION FOR THE RESPONSE ITEM

	Persona benefits	*Persona resources*	*Persona pitfalls*	**Communalities**
A12 - Personas are helpful for making design decisions.	0.818			0.662
A11 - Personas are helpful for understanding users' needs and context.	0.757			0.587
A13 - Personas are helpful for implementing and building.	0.708			0.507
A14 - Personas are helpful for evaluation.	0.565			0.382
A15 - Personas are helpful for communicating with stakeholders and team members.	0.457			0.245
A4 - Personas require expertise in qualitative research to create.		0.832		0.64
A2- Personas are expensive to create/use.		0.605		0.462
A3 - Representative personas require a lot of data.		0.599		0.424
A5- Personas require training in persona methods.		0.583		0.336
A6- Collaborating around personas is difficult.	-0.376	0.418		0.456
A10 - Persona sets often incorporate redundancy (multiple personas referring to the same characteristics).			0.956	0.781
A8 - Personas often represent extreme archetypes.			0.555	0.322
A9 - Personas often lack important information related to goals, needs, behaviors, and attitudes.			0.501	0.413
A7 - Personas are often not properly used by teams.			0.399	0.271
A1- Personas are time consuming to create/ use.		0.392	0.385	0.474

We used an EFA with Principal Axis Factoring (PAF) since PAF holds no assumption about the distribution of the data. The following steps were followed to ensure that validity and reliability of the final solution.

The survey data fulfilled the following suitability criteria:

1. Data on each item showed a correlation of at least 0.3 with at least one other item;
2. The Kaiser-Meyer-Olkin measure was 0.746 (greater that 0.6), and Bartlett's test of sphericity was significant ($\chi 2$ (120) = 435.131, $p < .001$);
3. The anti-image correlation matrix diagonals were all greater than 0.5;
4. The communalities were all above 0.3 except for A16, confirming that each A_k except k=16 shared some common variance with other items.

The second step was to decide the number of factors and rotation method. Initial eigen values were examined indicating that the first three factors explained 29%, 15%, and 10% of the variance respectively whilst the fourth and fifth factors had eigen values of just over 1, explaining 7% and 6% of the variance respectively. Also, the solutions for 3, 4 and 5 factors were each examined using varimax and oblimin of the factor loading matrix to interpret any correlation between the factors.

A three-factor solution, explaining 54% of the variance and using the oblimin rotation, was chosen given: 'leveling off' of eigen values on the Scree Plot after three factors; an inadequate number of primary loadings; difficulty in interpreting the fourth and fifth factor; and correlations between factors (0.3) i.e. F1, F3 (r=.39) and F2, F3 (r=.312). A16 ('Personas I use are usually well formed and adequate.') was eliminated since it failed to meet criterion of a min primary factor loading of .35 or above. A6 and A1 were retained even though both contributed to two factors. A6 ('Collaborating around personas is difficult') had a factor loading of 0.412 on F2 (resources for creating personas) and -0.366 on F1 (benefits of personas). One explanation for this is that practitioners see collaboration as a needed resource that presents a challenge from the perspective of persona creation. And from the perspective of practitioners' use, collaboration is not a persona benefit because it is difficult to apply. A1 ('Personas I create/use are time consuming') had a factor loading of 0.382 on F2 (relating to creating personas) and 0.38 on F3 (relating to the representation of personas. This was explained given that the question asked about "create/use" and the percentage of practitioners who create personas was 46% versus 54% who use them.

A PAF of the remaining 15 items using oblimin rotations was conducted, with three factors explaining 56% of the variance. Most items had primary loadings above 0.5 except for A7 and A15. A1 and A6 had cross-loadings into two factors (as explained above). The pattern loading matrix is presented in Table II with items presented in descending order of factor loading to indicate strength and direction with respect to factor. The 3 persona factors were named as follows:

- F1: *Personas benefits*, defined by 5 items positively and 1 item (A7) negatively. The descending order of the factor

loading A12, A11, A13, A14, A15, A7 indicated their strength within their factor.

- F2: *Persona resources*, defined by 6 items positively. The descending order of the factor loading A4, A2, A3, A5, A6, A1 indicated their respective within their factor.
- F3: *Persona pitfalls*, defined by 5 items positively. The descending order of the factor loading A10, A8, A9, A7, A1 indicated their respective within their factor.

TABLE III. FACTOR CORRELATION MATRIX

Factor	*Persona benefits*	*Persona resources*	*Persona pitfalls*
Persona benefits	1.000	-.151	-.366
Persona resources	-.151	1.000	.290
Persona pitfalls	-.366	.290	1.000

TABLE IV. COMPOSITE SCORES FOR PERSONA FACTORS

	Persona benefits	*Persona resources*	*Persona pitfalls*
Mean Std.	10.9247	11.6937	9.6429
Deviation	2.35362	2.56391	2.02689
Skewness	-1	-0.41	0.071
Kurtosis	1.729	0.861	-0.677

The reliability of the solution was tested by checking internal consistency of items in each factor. Cronbach's alpha of the 3 factors was good: personas benefits (6 items, α=.788), persona resources (6 items, α=.765), and persona pitfalls (5 items, α=.743). For the first factor, A6 was recoded to remove negative correlation. No substantial increases in alpha for factors could be achieved by eliminating more items. The fourth step computed the composite scores (Table IV) for each factor based on weight sum score of the items and loadings on each factor according to the following equation:

$$\sum_{it=1}^{n} (FL_{it} * S_{it})$$

where it = items in each factor, FL = Factor Loading, S = Score.

The results of the correlation matrix in TABLE III. along the composite scores in Table IV showed that UX/ID practitioners feel more strongly about the following factors.

1. P*ersona resources* was the highest factor, had a left-skewed distribution (Table IV), and was positively correlated (r≈0.3) with *Persona pitfalls* (Table III). This indicates that practitioners tend to think that persona resources are ranked first, and an increase in negative attitude towards *persona pitfalls* is likely to occur with an increase in negative attitude towards of *Persona resources*.
2. *Personas benefits* was the second highest factor, had a left-skewed distribution (Table IV) and was negatively correlated (r=-0.39) with *persona pitfalls* (Table III). This indicates that practitioners tend to think that benefits of personas come a close second, and an increase in negative attitude towards persona pitfalls is likely to occur with the decrease in positive attitudes to *persona benefits*.
3. *Persona pitfalls* was the third with normal distribution (Table IV), indicating that practitioners tend to think last about the pitfalls which tends to correlate with the previous two factors.

2) Attitudes towards Personas

We report responses to the items in the persona survey, including results of a one-sample sign test used to assess agreement with each proposition. In each of the bar charts (Figure 1─16), the left end of the red arrow indicates the lower bound of the 95% confidence interval and the dot indicates the estimated population median (note that in a number of cases these coincide).

A1: Personas are time-consuming to create/use

Figure 1 shows that the attitudes to this item were mostly positive with median and mode of 4. 62% responded on the 'agree' side of neutral (4 or 5) and 25% responded on the 'disagree' side of neutral (1 or 2). A one-tailed sign test was **highly significant** (p=.0004 and p-adjusted=0.03125) supporting H1 (agreement). The odds ratio was 2.5.

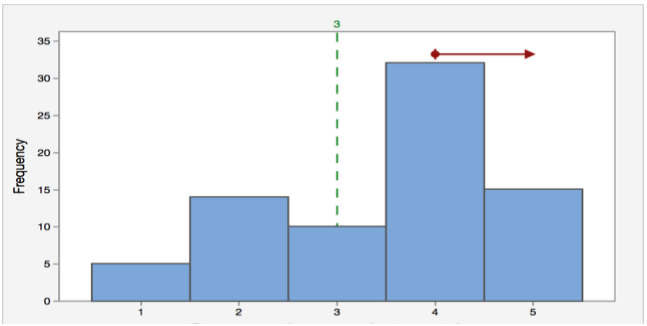

Figure 1. Personas are time-consuming to create/use

Conclusion: Practitioners tend to agree that personas are time-consuming to create/use.

A2: Personas are expensive to create/use

Figure 2 shows that the attitudes to this item were fairly even around neutral with a median of 3 and mode of 4. 34% responded on the 'agree' side of neutral (4 or 5) and 25% responded on the 'disagree' side of neutral (1 or 2). A one-tailed sign test was non-significant (1-tailed p=.7052 and p-adjusted=0.046875) supporting H0 (non-agreement). The odds ratio was 0.9.

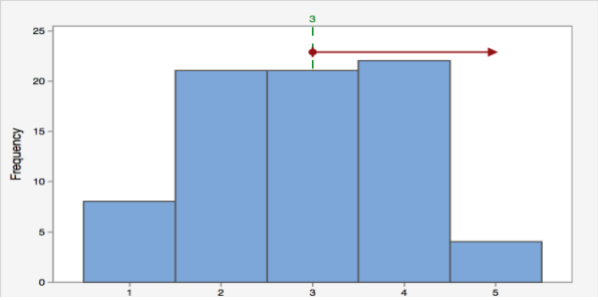

Figure 2. Personas are expensive to create/use

Conclusion: Practitioners tend **not to** agree that personas are expensive to create/use.

A3: Representative personas require a lot of data

Figure 3 shows that the attitudes to this item had a median and mode of 4. 54% responded on the 'agree' side of neutral (4 or 5) and 16% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (1-tailed *p* <.0001 and *p-adjusted*=.003125) supporting H1 (agreement). The odds ratio was 3.4.

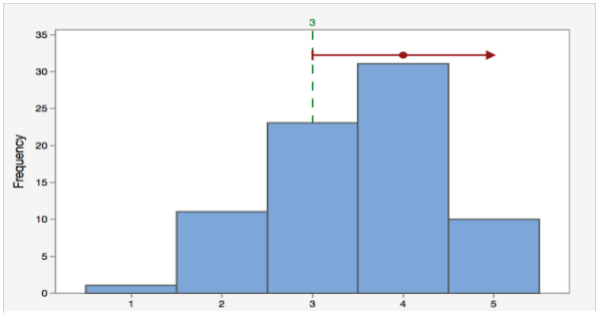

Figure 3. Representative personas require a lot of data

Conclusion: Practitioners tend to agree that representative personas require a lot of data.

A4: Personas require expertise in qualitative research to create.

Figure 4 shows that the attitudes to this item had a median and mode of 4. 72% responded on the 'agree' side of neutral (4 or 5) and 14% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (1-tailed p <.0001 and p-adjusted=.00625) supporting H1 (agreement). The odds ratio was 5.

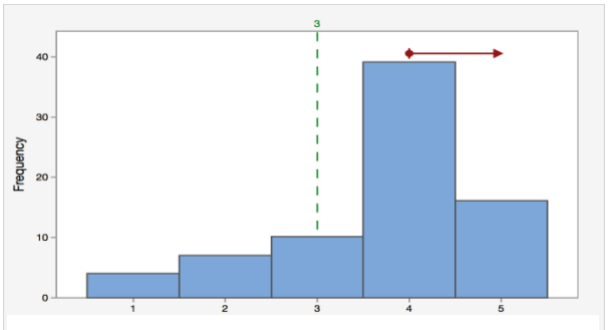

Figure 4. Personas require expertise in qualitative research to create

Conclusion: Practitioners tend to agree that personas require expertise in qualitative research to create.

A5: Personas require training in personas methods

Figure 5 shows that the attitudes to this item had a median and mode of 4. 66% responded on the 'agree' side of neutral (4 or 5) and 13% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (Z = 3.846, 1-tailed *p*<.0001 and *p-adjusted* =.00937) supporting H1 (agreement). The odds ratio was 5.

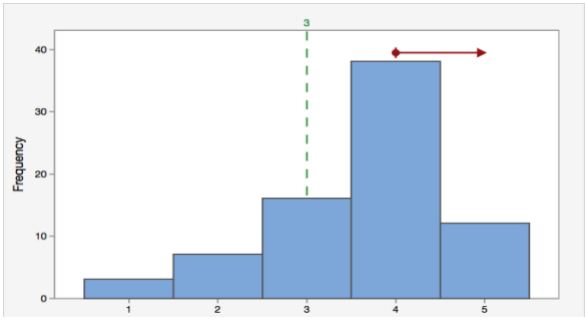

Figure 5. Personas require training in personas methods

Conclusion: Practitioners tend to agree that personas require training in personas methods.

A6: Collaborating around personas is difficult

Figure 6 shows that the attitudes to this item had a median of 3 and mode of 2. 34% responded on the 'agree' side of neutral (i.e., 4 or 5) and 39% responded on the 'disagree' side (1 or 2). A one-tailed sign test was non-significant (1-tailed *p*=.748 and *p-adjusted*=.05) supporting H0 (neutral or disagree) with an odds ratio (OR≈0.9).

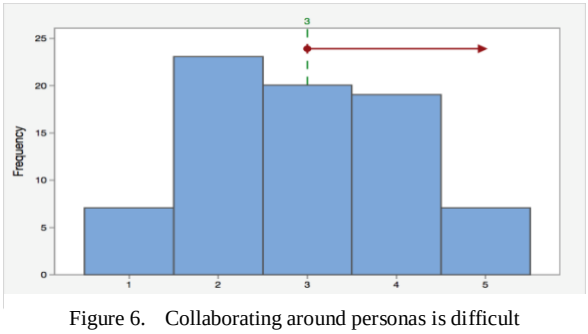

Figure 6. Collaborating around personas is difficult

Conclusion: Practitioners tend not to agree that collaborating around personas is difficult.

A7: Personas are often not properly used by teams

Figure 7 shows that the attitudes to this item had a median of 4 and mode of 5. 78% responded on the 'agree' side of neutral (i.e., 4 or 5) and 4% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (1- tailed *p*<.0001 and *p-adjusted*=.00125) supporting H1 (agreement). The odds ratio was 19.7.

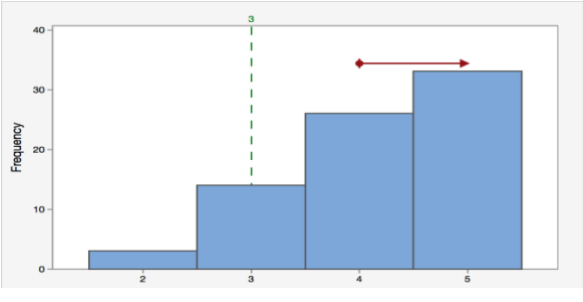

Figure 7. Personas are often not properly used by teams

Conclusion: Practitioners tend to agree that personas are often not properly used by teams.

A8: Personas often represent extreme archetypes

Figure 8 shows that the attitudes to this item had a median and mode of 3. 43% responded on the 'agree' side of neutral (4 or 5) and 22% responded on the 'disagree' side (1 or 2). A one-tailed sign test was found to be significant (1-tailed *p*=.025 and *p-adjusted*=.0344) supporting H1 (agreement) with an odds ratio of 1.9.

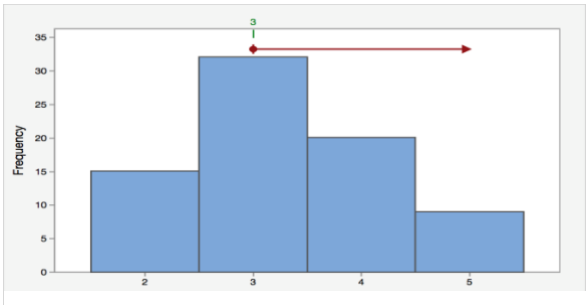

Figure 8. Personas often represent extreme archetypes

Conclusion: Practitioners tend to agree that personas often represent extreme archetypes.

A9: Personas often lack important information related to goals, needs, behaviors, and attitudes.

Figure 9 shows that the attitudes to item had a median and mode of 3. 42% responded on the 'agree' side of neutral (4 or 5) and 26% responded on the 'disagree' side (1 or 2). A one-tailed sign test was found to be non-significant (1-tailed *p*=.064 and *p-adjusted*=.0438) supporting H0 (neutral or disagree) with an odds ratio of 1.6.

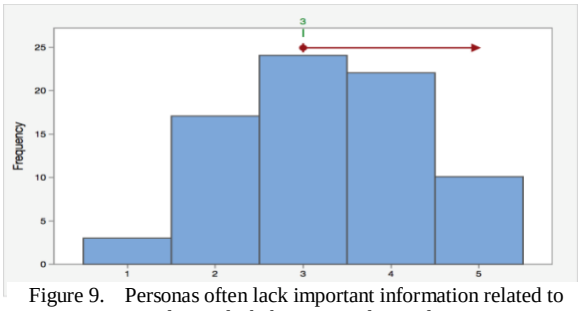

Figure 9. Personas often lack important information related to goals, needs, behaviors, and attitudes.

Conclusion: Practitioners tend not to agree that personas often lack important information related to goals, needs, behaviors, attitudes.

A10: Persona sets often incorporate redundancy

Figure 10 shows that the attitudes to this item had a median and mode of 3. 42% responded on the 'agree' side of neutral (4 or 5) and 26% responded on the 'disagree' side (1 or 2). A one-tailed sign test was found to be significant (1-tailed *p*=.064 and *p-adjusted*=.0438) supporting H1 (agreement). The odds ratio was 1.8.

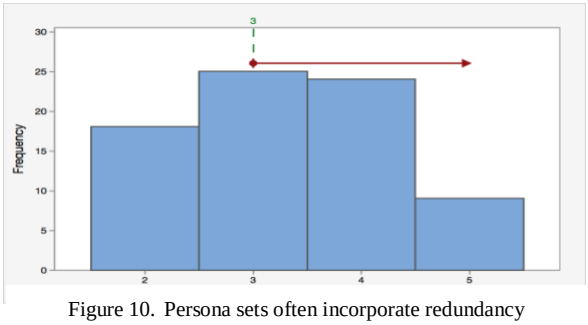

Figure 10. Persona sets often incorporate redundancy

Conclusion: Practitioners tend to agree that personas often incorporate redundancy.

A11: Personas are helpful for understanding users' needs and context

Figure 11 shows that the attitudes to this item had a median and mode of 4. 83% responded on the 'agree' side of neutral (i.e., 4 or 5) and 8% responded on the 'disagree' side. A one-tailed sign test was highly significant (1- tailed p<.0001 and p-adjusted=.015625) supporting H1 (agreement). The odds ratio was 10.5.

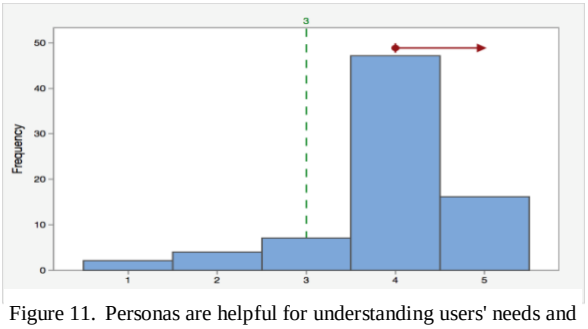

Figure 11. Personas are helpful for understanding users' needs and context

Conclusion: Practitioners tend to agree that personas are helpful for understanding users' needs and context.

A12: Personas are helpful for making design decisions

Figure 12 shows that the attitudes to this item had a median and mode of 4. 72% responded on the 'agree' side of neutral (i.e., 4 or 5) and 11% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (1-tailed *p*<.0001

and *p-adjusted*=.01875) supporting H1 (agreement). The odds ratio was 6.9.

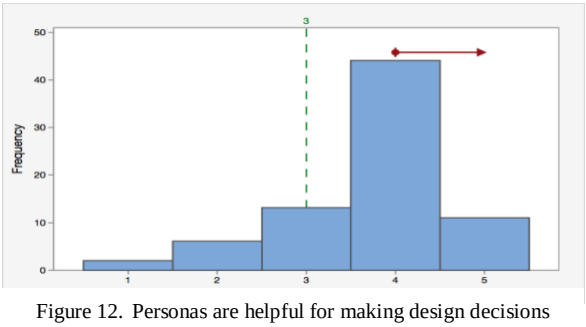

Figure 12. Personas are helpful for making design decisions

Conclusion: Practitioners tend to agree that personas are helpful for making design decisions.

A13: Personas are helpful for implementing and building

Figure 13 shows that the attitudes to this item had a median of 3 and mode of 4. 47% responded on the 'agree' side of neutral (4 or 5) and 28% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (1-tailed *p*= .0318 and *p-adjusted*= .040625) supporting H1 (agreement). The odds ratio was 1.7.

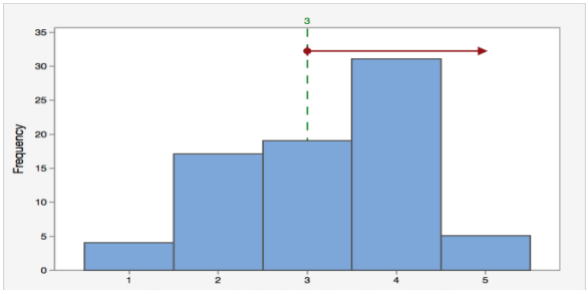

Figure 13. Personas are helpful for implementing and building

Conclusion: Practitioners tend to agree that personas are helpful for implementing and building.

A14: Personas are helpful for evaluation

Figure 14 shows that the attitudes to this item had a median and mode of 4. 68% responded on the 'agree' side of neutral (i.e., 4 or 5) and 12% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (1-tailed *p*= .0318 and *p-adjusted*= .021875) supporting H1 (agreement). The odds ratio was 5.8.

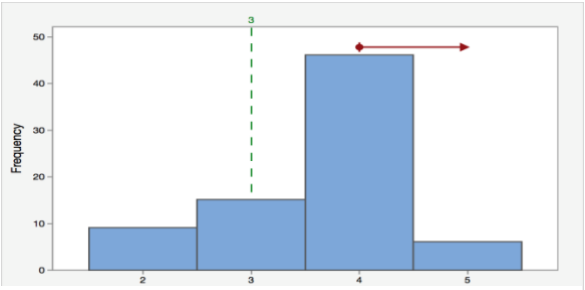

Figure 14. Personas are helpful for evaluation

Conclusion: Practitioners tend to agree that personas are helpful for evaluation.

A15: Personas are helpful for communicating with stakeholders and team members

Figure 15 shows that the attitudes to this item had a median and mode of 4. 75% responded on the 'agree' side of neutral (4 or 5) whilst 11% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (1- tailed *p*<0.001 and *p-adjusted*= .025) supporting H1 (agreement). The odds ratio was 7.1.

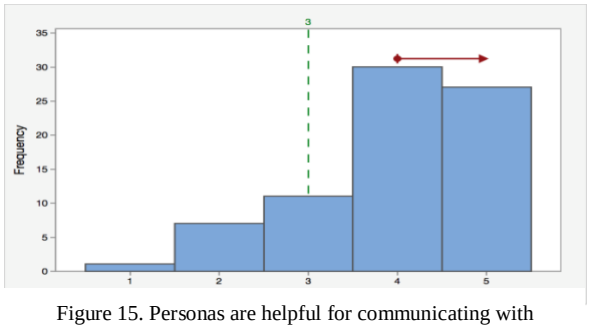

Figure 15. Personas are helpful for communicating with stakeholders and team members

Conclusion: Practitioners tend to agree that personas are helpful for communicating with stakeholders and team members.

A16: Personas I use are usually well formed and adequate

Figure 16 shows that the attitudes to this item had a median of 3 and mode of 4. 49% responded on the 'agree' side of neutral (4 or 5) and 16% responded on the 'disagree' side (1 or 2). A one-tailed sign test was highly significant (1-tailed p=0.003 and p-adjusted= .028125) supporting H1 (agreement). The odds ratio was 3.

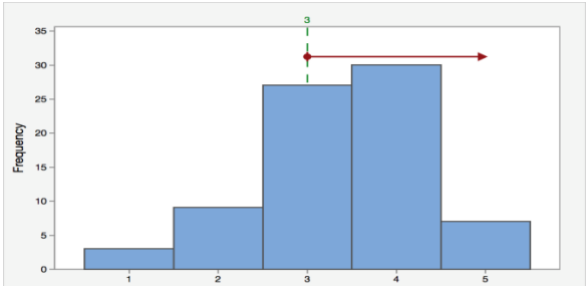

Figure 16. Personas I use are usually well formed and adequate.

Conclusion: Practitioners tend to agree that the personas they use are usually well formed and adequate.

We use the odds ratio to judge relative strength of opinion. Table V shows the items ordered by odds ratio. We use descending order (most strongly held view at the top). The 13 significant items are displayed first followed by the 3 non-significant items (A9, A2, A6).

TABLE V. PRIORITY OF ATTITUDES TOWARDS PERSONAS BASED ON THE DESCENDING ORDER OF OR RATIOS.

Priority	Attitude	OR ratio
1	A7: Personas are often not properly used by teams.	19.6
2	A11: Personas are helpful for understanding users' needs and context	10.5
3	A15: Personas are helpful for communicating with stakeholders and team members	7.1
4	A12: Personas are helpful for making design decisions	6.9
5	A14: Personas are helpful for evaluation	5.8
6	A5: Personas require training in persona methods.	5
7	A4: Personas require expertise in qualitative research to create.	5
8	A3: Representative personas require a lot of data.	3.4
9	A16: The personas I use are usually well formed and adequate.	3.1
10	A1: Personas are time consuming to create/use.	2.5
11	A8: Personas often represent extreme archetypes	1.9
12	A10: Persona sets often incorporate redundancy (multiple personas referring to the same characteristics)	1.8
13	A13: Personas are helpful for implementing and building	1.7
14	A9: Personas often lack important information related to goals, needs, behaviors, and attitudes	1.6
15	A2: Personas are expensive to create/use.	0.9
16	A6: Collaborating around personas is difficult.	0.9

V. CONCLUSION

Existing studies on personas are typically qualitative/ethnographic or case studies. They tend to involve small samples of practitioners with findings developed inductively. These studies are valuable for raising issues, but generalization can be difficult. Also, the claims in the literature are diffused, uncorroborated, and cannot be prioritized. The study reported here addresses these issues by providing a quantitative analysis of the views of a large number of practitioners.

The results show that persona use is quite prevalent amongst IxD/UX practitioners, particularly to capture the results of user research, but also to support design activities and to some extent, to support evaluation. We group attitudes into 3 dimensions (in order of importance): persona resources, persona benefits, and persona pitfalls. There was a weak negative correlation between persona resources and persona benefits, an acceptable negative correlation between persona benefits and persona pitfalls and an acceptable positive correlation between persona resources and persona pitfalls.

The survey showed that IxD/UX practitioners saw six kinds of resources as being consumed by personas with their order of importance indicated in Table VI. These findings provide a foundation for issues that might have the most impact when considering things like training needs, the design of persona creation methods and the design of persona support tools. Financial costs have also been considered a significant resource costs in the literature, and yet practitioners had an overall neutral opinion towards it. This might be explained by the fact that practitioners are more directly affected by time implications than they are by decisions about budgets.

In terms of persona benefits, practitioners tend to perceive six items with their order of importance indicated in Table VI and collaboration (although not significant for reasons explained earlier) affecting benefits negatively. Our findings on benefits of personas are similar to others and subset of the findings in [8]. Yet, our three highest ranked benefits did not show a difference in opinions between creators and users of personas as suggested by [12][14][18]. These findings indicate that personas are perceived as beneficial for practitioners (creators and users) despite resource concerns and this could provide implications for the priority of benefits that we need our future approaches to focus on.

Practitioners often had strong opinions about challenges that they face with personas. They tend to perceive five kinds of persona pitfalls. The literature has briefly addressed and introduced these (Table VI), but we wanted to explore if these pitfalls are common among practitioners. Our results show that there is one remarkably high ranked pitfall, which is that personas and often not properly used by teams, followed by time required to create them (also found under resources) and other relatively low ranked attitudes in terms of importance. As noted, time was also found under resources and this could be due to ambiguity in the stated term “time consuming to create/ use”, which may have been perceived as a resource for the creator, but a pitfall among persona users. This major finding indicates a need for design team members to work together around personas and for this to be addressed in methods and tools. Although collaboration was not explicitly addressed in literature, it was evident in some of the suggested persona development methods and practitioners had an overall neutral opinion towards it. This might be explained, not by a lack of collaboration difficulties, but by a lack of collaboration.

In future work, we plan to follow up on the findings reported here by exploring them more deeply in an interview study with IxD/UX practitioners and to use the findings to support the identification of requirements for persona creation tools. And as educators, given that personas are usually perceived as beneficial in the UCD, we would do well to continue to include personas in our university syllabi but to find approaches that overcome or at least educate students about the challenges of resources and common pitfalls.

TABLE VI. . SUMMARY OF OUR FINDINGS IN COMPARISON WITH LITERATURE (SUPPORTIVE/UN-SUPPORTIVE INDICATES OPINION ELICITED FROM OR OBSERVATION MADE OF REPORTED WORK).

Priority	Factors	Attitude	OR	Supportive	Unsupportive
6	Persona resources (1)	Personas require training in persona methods.	5	[3]–[5][9]–[11][16][20]	
7		Personas require expertise in qualitative research to create.	5	[3][4][10][11][14][18][20]	[7] [8]
8		Representative personas require a lot of data.	3.4	[4][9]–[11][20]	[18][27]
10		Personas are time consuming to create/use.	2.5	[3][8]–[10][12][19][20]	[7][8]
15		Personas are expensive to create/use.	0.9	[4][9]–[11][20][21]	[7][8]
16		Collaborating around personas is difficult	0.9	[4][10][14]	[15]
2	Persona benefits (2)	Personas are helpful for understanding users' needs and context.	10.5	[2]–[7][10][11][20][22]	[14]
3		Personas are helpful for communicating with stakeholders and team members.	7.1	[2]–[6][8][10][11][20][22]	[12]–[14]
4		Personas are helpful for making design decisions.	6.9	[3][4][6][8][10][11][22]	[14]–[16]
5		Personas are helpful for evaluation.	5.8	[11][19][20][22]	[21]
13		Personas are helpful for implementing and building.	1.7	[3][4][6][10][11][20][22]	
16		Collaborating around personas is difficult	0.9	[4][10][14]	[15]
1	Persona pitfalls (3)	Personas are often not properly used by teams.	19.6	[12][13]	[4][8][14]
10		Personas are time consuming to create/use.	2.5	[4][9]–[11][13][20][21]	[7][8]
11		Personas often represent extreme archetypes	1.9	[3][11][22]	
12		Persona sets often incorporate redundancy	1.8	[3] [4]	
14		Personas often lack important information related to goals, needs, behaviors, and attitudes.	1.6	[20]	[2]–[6][10][11]
9		My personas are usually well formed and adequate.	3.1		[21]

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