How to Construct an Ideal Collaboration Tool for Coworking Spaces: An SP-CBC Application

Cristopher Siegfried Kopplin and Daniel Baier

Abstract Coworking spaces both require and foster communication and collaboration among members and providers' staff as well as between members and providers. A variety of tools, denominated Workstream Collaboration software, seeks to fulfill this purpose. We show how a single-product choice-based conjoint (SP-CBC) approach can be used to develop an ideal Workstream Collaboration tool. 300 coworking spaces in Germany were used for data collection. The application shows the viability of the proposed approach and highlights the importance of an applications' dissemination, modern security standards, and a plurality of collaborative instruments. We find network effects to be a tool's critical feature. Communication functionality, surprisingly, seems to play only a subordinate role.

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1 Introduction

Coworking spaces (in the following shortly: CWS) are a rapidly growing phenomenon in the working environment and as such have gained attention from researchers in a variety of disciplines, such as entrepreneurship (Bouncken and Reuschl, 2016; Bouncken et al., 2018), organizational research (Garrett et al., 2017), innovation research (Schmidt and Brinks, 2017), and human geography (Brinks, 2012). However, many aspects of CWS have not been under any form of investigation yet. CWS offer workspace for rent and provide flexible access to infrastructure at variable fees, creating social hubs (Brinks, 2012; Gandini, 2015; Garrett et al., 2017). The idea of CWS is rooted in the sharing economy, which denotes the concept of gaining temporary access to tangible or partly tangible resources, facilitated by means of information systems (Hawlitschek et al., 2018). Subsequently, coworking, the expression for participating in a CWS as a member, has several distinctive features that differ from conventional deskwork. Most prominently, these comprise the style of communication and collaboration and correspondingly the sharing of knowledge and resources (Bouncken and Reuschl, 2016). However, these features do not establish automatically, but have to emerge organically from the CWS environment. Interaction between CWS members is essential, and consequently, any means that touches inter-member exchange directly affects the coworking space itself (Bouncken and Reuschl, 2016; Garrett et al., 2017). Software that is used in the coworking context hence needs to cater for the specific needs of CWS members. Implied by the nature of CWS, communication and collaboration are the fundamental aspects of such software tools.

The open social atmosphere of CWS offers a nutrient medium for innovation: Studies on success factors for new products identify communication and collaboration as essential parameters (Cooper and Kleinschmidt, 1987; Rese and Baier, 2011; Cooper, 2019). Innovations are typically managed in a stage-gate process (Cooper, 1990), a standardized reference guideline comprising process steps (stages) and checks (gates). Stage-gate has been refined over the years to cater for changes in the organizational environment, leading to the integration of agile methods in the latest step of development (Paluch et al., 2019; Vedsmand et al., 2016). Agile methods themselves are already heavily supported by software tools used in CWS (Slack, for example, lists 20 integrations for Scrum in its app directory).

The paper at hand seeks to conceptualize an ideal software tool by conducting a single-product choice-based conjoint analysis (in the following shortly: SP-CBC) in CWS in Germany. The first section gives a review of the relevant literature in order to identify central functional aspects and to set the outlines for the software. Software usage in CWS is diffuse and lacks guidelines. Research on Workstream Collaboration tools, in particular, is scarce and mostly based on practitioner-focused examinations (see e.g. Gartner, 2018; Reynolds, 2018). In this paper, we provide an outline for scientific investigation of software applications in the coworking context, as well as a basis for analysis of Workstream Collaboration tools. The remainder of the paper is structured as follows: Section 2 describes the theoretical background of CWS and Workstream Collaboration tools. Section 3 explores how SP-CBC can be used to construct an ideal Workstream Collaboration application. Section 4 displays our research design, specifically exploring possible attributes for the conjoint analysis, and the empirical application. Section 5 provides discussion and conclusion of our results, and the final section 6 outlines limitations and directions for future research.

2 Collaboration Tools for Coworking Spaces

The sharing economy introduced CWS as both workspace and social hubs for rent (see e.g. Brinks, 2012; Capdevila, 2013; Gandini, 2015; Garrett et al., 2017). The underlying cultural model claims a set of five values: Collaboration, community, sustainability, openness, and accessibility (Schürmann, 2013), what sets them apart from other forms of rentable workspace. As Bouncken and Reuschl (2016, p. 318) put it: “Coworking integrates different elements of home-office concepts, office communities, tele-centers, telework, virtual work, virtual teams, incubators, and communities of practices but specifically offers a cross-sectoral working community with more flexibility, autonomy, and opportunities for social interaction”.

They form so called third places that are sited between home and regular work (Oldenburg, 1999; Schopfel et al., 2015). Teams and work processes can be flexibly chosen, in contrast to project and virtual teams in the hierarchies of established firms (Chesbrough and Teece, 1996; Bouncken and Reuschl, 2016). CWS are also not restricted to certain geographic locations such as Europe or the US, but emerge all over the world, e.g. in Africa, Asia, and South America (Merkel, 2015). CWS are characterized by

(1) flexible rental models,

(2) high cost efficiency and

(3) community-orientation that "facilitate encounters, interaction and a fruitful exchange between diverse work, practice, and epistemic communities and cultures" (Merkel, 2015, p. 122).

They provide material amenities such as (3D) printers, fax machines, WiFi, coffee machines, kitchens, and lounge areas, but also immaterial virtues in the form of business presentations, seminars, exhibitions, or conferences (Spinuzzi, 2012; Schopfel et al., 2015). The social aspects of community and collaboration are vital motivators for participating in coworking (Garrett et al., 2017). Bouncken and Reuschl (2016) extend this view and describe CWS as institutions for innovation on the individual, team, venture, and (for CWS integrated in incumbent organizations) corporate level. Schopfel et al. (2015, p. 72) put it as "creating links between individuals and groups, increasing the permeability of group boundaries and opening the space to individuals, groups and networks 'outside'".

These characteristics imply that the rise of CWS is strongly connected to the availability of new information and communication technologies. These increase the number of remote workers and employees working from home and third places, respectively (Spinuzzi, 2012; Merkel, 2015). However, social interaction and collaboration among coworkers and between coworkers and externals incorporates the online as well as the offline world (Gandini, 2015; Schopfel et al., 2015; Bouncken et al., 2018) and, therefore, requires flexible and versatile support tools.

Developments in IT provide diverse applications and solutions to support CWS members with their tasks. Especially the flexibility of teams and work processes requires adequate assistance. Workstream Collaboration software, oftentimes simply referred to as Workstream Collaboration, describes the next development stage of integrated communication and collaboration (Gartner, 2018). We will use the term Workstream Collaboration tools in full to avoid confusion between WSC and CWS. Furthermore, we differentiate between a collaborative work process (i.e., Workstream Collaboration), and supporting software applications (i.e., Workstream Collaboration tools). This novel submarket has risen to prominence around its most renowned product, Slack, a collaboration tool from the company with the same name. Workstream Collaboration tools have not been the subject of major research, thus the study at hand seeks to shed light on this emerging trail of software applications.

When Microsoft tackled the market with their tool Microsoft Teams in 2017, Workstream Collaboration tools started to get major traction (Unify Square, 2019). Gartner (2018) defines Workstream Collaboration tools as products that allow the organization, coordination, and execution of projects and processes where a high level of team work is required for effective results, enabled by a conversation-centric, collaborative environment for high individual as well as group performance. Reynolds (2018, n. pag.) complements this view: Workstream Collaboration tools bring "messaging, notifications, files, bots, tools and people together to create a private, persistent and searchable digital workspace that teams can use to do their work in a transparent, effective and efficient manner". He highlights the aspect of bringing all necessary functionality together, in the form of automation, bot usage, and integration of external applications. Figure 1 depicts the main elements of Workstream Collaboration tools.

<table>
<tr><td colspan="3">Awareness and Discovery
(Personalization, Search, Alerts/Notifications, ...)</td></tr>
<tr><td rowspan="5">Persistent Conversation Space
(Groups, Channels, Direct Messaging)</td><td>Audio and Video Sharing</td><td>Conversational Interfaces</td></tr>
<tr><td>Screensharing</td><td>Content Collaboration Platforms</td></tr>
<tr><td>Filesharing</td><td>Security and Compliance</td></tr>
<tr><td>Automation/Bots</td><td>Enterprise Integrations</td></tr>
<tr><td>Integrations</td><td>Analytics and Reporting</td></tr>
<tr><td colspan="3">Workstream Collaboration Platform
(Infrastructure Services, Graphing, AI-related Services, APIs, SDK, ...)</td></tr>
</table>

Figure 1: Main elements of Workstream Collaboration software, based on Gartner (2018).

What distinguishes Workstream Collaboration tools from other fields such as Unified Communications is the mode of interplay of both communication and collaboration, particularly discovery functionality, integrations, and persistent filesharing and robust document management, respectively (Unify Square, 2019). When it comes to applying Workstream Collaboration software, typical use cases reflect a state-of-the-art organizational scenario with many non-routine tasks and challenges (Reynolds, 2018). It is strongly driven by digitalization, which becomes particularly evident in its user experience focus: Instead of including features that are available due to technological advances, it seeks to support human communication best possible by incorporating the latest achievements from a variety of disciplines (Reynolds, 2018). When choosing a software solution, IT application leaders have multiple vendor options. Reynolds (2018) lists communications service providers (CSPs, e.g. AT&T), office suite vendors (e.g. Microsoft), application specialists (e.g. Fuze), Unified Communication platform vendors (e.g. Mitel), and value-added service providers (e.g. Masergy).

3 How to Construct an Ideal Collaboration Tool Using SP-CBC

Research on success factors in new product development (NPD) has shown that product advantage in the eyes of the customers and the integration of the customers' point of view are of major importance (Cooper, 2019; Cooper and Kleinschmidt, 1987; Di Benedetto and Dayan, 2009; Evanschitzky et al., 2012; Hoegl and Gemuenden, 2001; Rese and Baier, 2011). Already in the early stages of the new product development process – from ideation to market implementation – (samples of) customers should be interviewed and their preferences with respect to the product's (later) functionality and design should serve as a guideline along stages where the product is concretized and gates where quality requirements and need fulfillment are checked (Cooper, 1990; Chang and Taylor, 2016).

Especially when a wide range of functionality and design options exists among which the developers have to make decisions, a conjoint analysis approach is applied to understand and integrate the customers' point of view (see e.g. Steiner and Meißner, 2018). This approach mainly consists of the following five steps:

(1) Definition of attributes and corresponding levels (i.e., describing the space of functionality and design options in form of a morphological table).

(2) Stimuli construction (i.e., combining attribute-levels to prepare the collection of responses like choices among subsets of stimuli, preference rankings, or buying intentions from customers).

(3) Collection of responses from a sample of customers.

(4) Preference modeling (i.e., estimating the contribution to overall preferences from the different attribute levels that describe the stimuli).

(5) Interpretation of the results to derive ideal attribute level combinations (e.g., with respect to overall preferences, choice probabilities, sales volume or profit).

For many years, choice-based conjoint analysis (CBC) has been the standard methodology for this purpose. Here, in step (3) the respondents are confronted with sets of stimuli among which they have to select the most preferred one (sometimes also allowing a no-option when none of the presented stimuli is preferred) and in step (4) a multinomial logit model is used to estimate the contribution to overall preferences from the different attribute levels (part-worths).

Recently, Chrzan (2015) discussed a variant of this approach, the so-called single product choice based conjoint analysis (SP-CBC) that uses only one stimulus at a time when collecting preferences from respondents in a CBC manner (Chrzan, 2015). Part-worths are estimated according to a binary logit model that describes a choice between a stimulus presented and a no-choice or none-option. Besides its connections to CBC, SP-CBC is of course also closely connected to discrete choice theory and its applications, e.g. when investigating transportation mode choices (see e.g. McFadden, 1974).

As already mentioned, the new approach mimics a situation in which an individual has to make a binary decision of either using a novel concept or not (i.e., he or she sticks to previous instruments, reflected by choosing 'none'). The none-option in general can be a 'real' none-option (no shown concept is acceptable), a constant alternative concept, or an 'own-choice' option, referring to the individual keeping with his or her previously used alternative (Batsell and Louviere, 1991; Haaijer et al., 2001; Louviere and Woodworth, 1983). However, in the SP-CBC context only the 'own-choice' interpretation is reasonable. In SP-CBC, it is also possible to include alternatives which are not characterized by conjoint attributes, but merely by their brand names, when these products are so well-known that they do not require further description (see e.g. Chrzan, 2015, for application in the context of pharmaceutical prescriptions). Including alternatives besides the none-options increases the number of parameters to estimate and hence makes higher demands on sample size. It should be mentioned that in recent versions of the standard software for applying CBC (Sawtooth Software, 2017), SP-CBC is integrated as a CBC variant with various application possibilities (Chrzan, 2015).

In the following we apply SP-CBC to develop an ideal Workstream Collaboration tool. Here, we do not make the assumption of self-evident alternatives, and only employ the none-option. In this vein, SP-CBC creates a natural setting of buying behavior, where one novel alternative is critically observed (as displayed by attributes and levels). This allows delimiting the amount of information an individual has to process before making a selection, compared to conventional choice-based conjoint analysis. In our study of 14 tasks, SP-CBC features 14 concepts, whereas CBC would provide as much as 56 (at a rate of four concepts per task). This significantly reduces the cognitive burden for individuals and might induce more conscious decision making. Still, the issue of eliciting preferences through choices remains with SP-CBC.

4 Empirical Application to Construct an Ideal Collaboration Tool

(1) *Definition of Attributes and Corresponding Levels*

As mentioned above, SP-CBC is used to determine partial utilities and to conceptualize an optimal attribute level combination for a Workstream Collaboration tool. For the first step from the above described five conjoint analysis steps, a pool of possible attributes was created by collecting information from providers' websites, reviewing relevant literature in the field, and evaluating review websites such as Capterra and blogs discussing software used in CWS and software for communication and collaboration in general. Overall, a set of seven attributes was fixed. This number was reduced to four in a review process with collaboration tool users and experienced communication software operators. Attribute levels were determined alike. Table 1 provides the final attributes and the corresponding levels.

Table 1: Conjoint attributes and attribute levels.

Communication	Collaboration	Network Effects	Security
Basic functionality (text and video chat, screensharing)	Basic functionality (filesharing)	20% of business partners use the application	Basic functionality (message encryption)
Advanced functionality mentioning, search function, polls)	Advanced functionality (versioning, collaborative real-time editing)	50% of business partners use the application	Advanced functionality (two-factor authentification, certificates)
Extensive functionality (email, fax, phone)	Extensive functionality (wikis, blogs, newsfeed)	100% of business partners use the application	Extensive functionality (disaster recovery and business continuity)

(2) *Stimuli Construction*

This number of attributes fits Sawtooth Software's recommendation of six or fewer attributes for CBC (including SP-CBC now as a variant), especially of preferring CBC over adaptive CBC for four attributes or less (Sawtooth Software, 2009). We also followed the suggestions of using 8 to 15 choice tasks and employed 12 random and 2 fixed tasks and designed the study as Balanced Overlap (Sawtooth Software, 2017). Communication covers modes of interpersonal interaction. Collaboration is featured as a distinct attribute and comprises cooperative functionalities. Network effects consider the variety of different Workstream Collaboration solutions and incorporate different extents of a tool's dispersion, and lastly security deals with confidentiality, privacy aspects, and safe data storage. The attribute levels are orthogonal and do not require exclusion of combinations.

(3) *Collection of Responses*

Participants were recruited from CWS in Germany using a cluster sampling approach to select a CWS in the first step and then interview the space's members. In order to compile a list of CWS, several websites offering bookings and desk reservations were evaluated. The result list was completed via manual analysis of both coworking and coworker blogs, newspaper articles about CWS, and search engine queries, giving an exhaustive overview of the German coworking landscape. 300 spaces were identified, of which 40 CWS were randomly chosen for sampling. Questionnaires were distributed online using Sawtooth Software. Data collection took place in January and February 2019 over a period of four weeks. 53 surveys were completed.

Full-profile choice-based conjoint design was employed using 12 discrete choice tasks in combination with two holdout stimuli. Partial utilities were used for preference modeling (Green and Srinivasan, 1978). To calculate part-worth utilities, Hierarchical Bayesian estimation was conducted with 20,000 iterations.

(4) ***Preference Modeling***

Out of the 53 respondents, 31 were male and 22 were female. Coworkers in employee (32 %) and freelancing positions (27 %) accounted for the main groups in our sample. The second largest groups, however, were entrepreneurs with employees as well as employees with their employer sited at the same CWS (14 % respectively). Concerning the length of the relationship between the coworker and the CWS community, we identified a U-shaped distribution: Coworkers either stay for a very short period (less than a month, 32 %) or establish a long-term commitment (more than six months, 27 %) with less respondents stating time periods in between. Respondents branch affiliation had a focus on Marketing (27 %) and Consulting (23 %), both rooted in the field of business administration. IT-based occupations followed with 14 %. We used two holdout stimuli for evaluating our utility estimation's accuracy, which yielded hit rates of 0.71 for the first fixed task, and 0.94 for the second.

(5) ***Interpretation of Results***

Responses for tool awareness showed that the stand-alone major streams that make up Workstream Collaboration tools, namely communication, collaboration, and project management, are well known among coworkers.

Table 2: Part-worth utilities using Hierarchical Bayes estimation and segment-specific calculation. Standard deviation in parentheses. Values marked with an asterisk (*) differ significantly between groups based on a T-test with a significance level of 0.05.

Attribute level		**Mean part-worth utilities** (standard deviation)
Communication		
Basic functionality		-6.03 (17.26)
Advanced functionality		-3.41 (24.13)
Extensive functionality		9.00 (15.85)
Collaboration		
Basic functionality		-15.31 (29.69)
Advanced functionality		-4.35 (18.17)
Extensive functionality		19.66 (20.70)
Network effects		
Small (20 %)		-109.00 (31.01)
Medium (50 %)		-2.98 (27.43)
High (100 %)		111.98 (29.72)
Security		
Basic functionality		-9.84 (47.77)
Advanced functionality		-8.92 (35.46)
Extensive functionality		18.77 (20.21)
NONE		8.85 (58.88)
Importances		
Communication		10.69 (5.16)
Collaboration		13.94 (7.76)
Network effects		55.43 (13.27)
Security		19.94 (10.33)
	Group 1 short-term	**Group 2** long-term
Communication		
Basic functionality	-6.81 (9.87)	-2.06 (17.85)
Advanced functionality	-4.12 (24.34)	-12.39 (25.80)
Extensive functionality	10.93 (21.87)	14.45 (18.37)
Collaboration		
Basic functionality	-35.64 (30.98)	-10.20 (27.78)
Advanced functionality	2.98 (22.92)	-7.89 (11.14)
Extensive functionality	32.65 (12.94)	18.09 (24.58)
Network effects		
Small (20 %)	-108.34 (18.90)	-117.70 (19.44)
Medium (50 %)	6.05 (33.24)	10.80 (13.05)
High (100 %)	102.29 (23.86)	106.90 (22.93)
Security		
Basic functionality	-40.33 (28.86)	1.35 (43.66)
Advanced functionality	*16.12 (28.45)	-18.71 (18.90)
Extensive functionality	24.21 (18.68)	17.35 (25.63)
NONE	-7.99 (54.60)	21.86 (58.68)
Importances		
Communication	10.74 (3.12)	12.43 (3.26)
Collaboration	18.11 (9.92)	13.32 (5.25)
Network effects	52.66 (6.84)	56.15 (10.12)
Security	18.49 (12.07)	18.10 (7.05)

Communication tools such as Discord, Hangouts, or Skype yielded a positive response rate of 100 %, followed by collaboration applications such as Slack, Circuit, or Mattermost with 91 %. Project management-supporting tools such as Trello, Asana, or Airtable yielded more mixed results with 68 % of the respondents knowing them.
Network effects were by far selected as the most important aspect. 100 % of the business partners using the application yielded the highest part-worth, whereas 50 % and merely 20 % dissemination resulted in strong negative outcomes. Extensive collaboration functionality including wikis, blogs, and newsfeeds besides filesharing, versioning, and collaborative real-time editing ranked second, also followed by negative part-worth utilities for the lower levels. Security features, which are inherent to software in general, displayed a preference for an overall support not only including message encryption and two-factor authentification but full disaster recovery and business continuity functionality. Communication aspects, however, yielded the lowest part-worth utilities in the same pattern as the preceding three attributes with a preference for the most extensive level (text and video chat, screensharing, mentioning, search function, polls, mailing, fax, and phone) and utility loss for the remaining two minor levels. From an average importance perspective, network effects account for 55 % of a Workstream Collaboration tool's utility, clearly set apart from security (20 %), collaboration (14 %), and communication (11 %). Table 2 summarizes the part-worth utilities and the average importance of the attributes.

Regarding the U-shaped distribution of CWS affiliation, we further segmented our dataset into two groups, only containing coworkers that work less than one month in their CWS (group 1), and more than six months (group 2), respectively. Due to small sample size, these descriptive statistics may serve as qualitative insights only, and need further investigation for reliable conclusions.

5 Discussion and Conclusion

Unsurprisingly, respondents chose high network effects as the major utility driver. This fits the findings of Merkel (2015) that spatial adjacency and concurrent presence of coworkers do not necessarily lead to collaboration. Instead, they often work alongside one another with bare interaction or cross-fertilization (Spinuzzi, 2012). Network effects were modelled in order to represent the cases of an industry standard (100 %), an oligopoly similar to Android versus iOS

(50 %), and a fragmented market with a number of more well known applications (20 %). The clear preference for an industry standard may not be met in terms of one tool with 100 % market share, but in the form of perfect compatibility of different tools, as in the case of e-mails, to enable channel sharing between two or more applications.

Security concerns display an awareness for the downsides of the technology, indicating a considerable technological "literacy" necessary for future evolution of work processes. Communication aspects, however, held surprisingly low parth-worth utilities regarding the central pillars of Workstream Collaboration tools. This may be explained by the socio-material setting of CWS, fostering personal interaction remote from notebooks and smartphones and allowing coworkers to focus on mere working while using collaboration platforms. The annual coworking survey by Deskmag (2018) reports that within the spaces, coworkers continually move closer over the years as the square meters per member gradually drop (from 13.5 in 2016 to 12.2 in 2018), which may also support face-to-face communication. The high awareness of stand-alone communication applications (e.g. Skype, Discord) also indicates that coworkers have an overview of a number of solutions and do not require a novel tool to implement features they already know where to source. In the case of collaboration functionality, more seems to be better. Workstream Collaboration tools hold the potential to replace previous instruments from a range of fields, e.g. mails, fax machines, or phones, and offer all channels on a one-serves-all platform. Coworkers seem to have recognized this alignment and consider it as the tools' unique selling proposition.

Overall, our results indicate a good fit between Workstream Collaboration tools and CWS. Both share a strong focus of connecting people for getting work done. A rather surprising finding is who actually was to be connected, yielding Marketing and Consulting as the top two branches. Another interesting result is the U-shape of CWS contracting with both short-term and long-term coworkers outnumbering time spans in between. Taking into account different motives for CWS membership, both groups are likely to differ in their perception of CWS' benefits. Short-term coworkers (membership shorter than a month) fit the persona of the isolated home office worker who switch their location to finish a project, as early CWS had in mind. Long-term members likely identify with the cultural values of coworking and make a deliberate decision to adopt this mode of work.

6 Limitations and Future Research

Single-product choice-based conjoint analysis was applied to generate an optimized Workstream Collaboration tool concept. Samples were drawn using a cluster sampling approach, thus sample composition may differ from population structure. We incorporated approximately 300 spaces located in Germany, which is close to all existing providers, and sampled 40 sites for census. Responses were relatively sparse with 53 completed questionnaires. CWS are also not limited to Germany but a global phenomenon. Results, therefore, are not offhandedly representative for CWS in general.

This paper investigated the composition of an ideal Workstream Collaboration tool on a package-level ranging from basic to extensive functionality. Future studies might tackle the attributes in higher detail, particularly incorporating the variety of bots and third-party integrations that are characteristic of Workstream Collaboration tools. As applications are advancing and comprising more and more business-critical features, comprehensive investigations of usage behavior and its consequences for work processes may rise to interest as well.

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