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Relation between Experience Categories and Psychological Needs

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Abstract: Knowledge about human behaviour and motivation is essential for designing a positive user experience (UX). Theories of psychological needs have been profoundly researched and well-established in UX research. Experience categories are a rather new practical human-centred design method; they are not based on a psychological model, but instead on an empirical approach. Experience categories describe common positive experiences in a particular context. According to Hassenzahl, positive experiences result from the fulfilment of psychological needs. However, there has been no research on how experience categories and needs are associated. To fill this gap and enrich the knowledge about experience categories, we investigated which needs co-occur with them. In Study 1, we used a more general approach: experience categories of work context were operationalised with scenarios that were rated with a needs questionnaire. In Study 2, we aimed to replicate the findings of Study 1 in a more specific work context by investigating the relationship between experience categories and needs for an existing sample of experiences. Results show a consistent relationship between some experience categories and needs in both studies. Moreover, the need for competence was particularly relevant in the work context. Future studies should expand on this research to further work contexts.

Keywords: experience category; psychological need; user experience

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1. Introduction

In 1943, Abraham Maslow published his theory of human motivation in which he presented the famous hierarchy of needs [1]. The hierarchy includes physiological needs, safety needs, love and belonging, and self-esteem and self-actualisation. Since then, psychological needs have been a constant research subject in psychology. Various research groups have presented different collections of psychological needs. For example, in their self-determination theory [2], Ryan and Deci postulated *competence*, *autonomy*, and *relatedness* as the driving forces for self-motivation and mental health. Sheldon and colleagues [3] found *autonomy*, *competence*, *relatedness*, and *self-esteem* to be the most important characteristics of pleasurable events for increasing people's happiness. Their list also included *security*, *pleasure–stimulation*, *self-actualisation–meaning*, *popularity–influence*, *physical thriving*, and *money–luxury*, but holding less important functions. On the basis of this list, a questionnaire was developed to assess which needs are addressed in a certain event. Psychological needs were considered and researched on human behaviour before eventually finding their way into human-centred design. In 2008, Marc Hassenzahl presented his definition of user experience (UX) in which he described that a positive UX is the consequence of the fulfilled psychological needs of the user [4]. He listed the needs for *autonomy*, *competence*, *stimulation*, *relatedness*, and *popularity*. Since then, psychological needs have been used regularly in design processes and prepared as design tools by different research groups [5–7]. In 2020, Pieter Desmet and Steven Fokkinga presented an updated framework of psychological needs [8] that consisted of 13 fundamental needs and 52 subneeds (see Table 1). The revised

framework is based on a reviewed compilation of fundamental needs derived from six psychological theories. With the exception of *self-esteem* and *luxury–money*, the framework includes all of Sheldon and colleagues' wellbeing factors [3], as shown in Table 2. Psychological needs are the source of motivated human behaviour. Fulfilled needs lead to positive emotions and, thus, to wellbeing. They are abstract and universal, and inspire behaviour in all kinds of situations and circumstances.

Table 1. Thirteen fundamental psychological needs according to Desmet and Fokkinga [8].

Fundamental Need	**Subneed**
Autonomy	Freedom of decision Individuality Creative expression Self-reliance
Beauty	Unity and order Elegance and finesse Artistic experiences Natural beauty
Comfort	Peace of mind Convenience Simplicity Overview and structure
Community	Social harmony Affiliation and group identity Rooting (tradition, culture) Conformity (fitting in)
Competence	Knowledge and understanding Challenge Environmental control Skill progression
Fitness	Nourishment Health Energy and strength Hygiene
Impact	Influence Contribution To build something Legacy
Morality	Having guiding principles Acting virtuously A just society Fulfilling duties
Purpose	Life goals and direction Meaningful activity Personal growth Spirituality
Recognition	Appreciation Respect Status and prestige Popularity
Relatedness	Love and intimacy Camaraderie To nurture and care Emotional support

Table 1. *Cont.*

Fundamental Need	Subneed
Security	Physical safety Financial security Social stability Conservation
Stimulation	Novelty Variation Play Bodily pleasure

Table 2. Comparison of factors of wellbeing [3] and fundamental needs [8].

Factors of Wellbeing [3]	Fundamental Needs [8]
Autonomy	Autonomy
-	Beauty
-	Comfort
-	Community
Competence	Competence
Physical thriving	Fitness
(Popularity–) influence [1]	Impact
-	Morality
Meaning; Self-actualisation	Purpose
Popularity (–influence) [1]	Recognition
Relatedness	Relatedness
Security	Security
Stimulation–pleasure	Stimulation
Self-esteem	-
Luxury–money	-

[1] Desmet and Fokkinga [8] subdivided Sheldon and colleagues' [3] need 'popularity—influence' and assigned it to different fundamental needs.

There are other design tools that aim to support design for wellbeing that are more concrete and refer to special contexts. Positive practices [9,10], for example, are derived from successful practices in everyday life in a certain context (e.g., physical activity in predominantly sedentary working life [10]) and are then used in design processes. Another approach that refers to specific contexts and is also more empirical is the so-called experience categories [11–13]. The basic idea in the development of the experience categories can be traced back to Hassenzahl's definition of experiences: "An experience is an episode, a chunk of time that one went through—with sights and sounds, feelings and thoughts, motives and actions; they are closely knitted together, stored in memory, labeled, relived and communicated to others. An experience is a story, emerging from the dialogue of a person with her or his world through action" [14] (p. 8). Important elements of the definition are the affects (feelings—negative, neutral, and positive) giving the experience the character of being a positive or negative experience [4]. As mentioned before, Hassenzahl performed the important step of explaining that a positive experience is a result of fulfilling psychological needs during the interaction with a product [4,15]. Fulfilling psychological needs is related to the activities and circumstances that allow for fulfilment [9,14]. To understand specific experiences in specified contexts, we developed [11–13] am approach to collect stories of positive experiences by running so-called experience interviews [16]. Tuch and colleagues [17] concluded that collecting experience stories is a well-functioning and well-established approach, and a so-called paradigm of UX research. The experience interviews allow for understanding the positive experiences in detail, for example, the associated emotions, the used technology, other involved persons, the underlying activity, the situational conditions and so forth. The collected experiences are then categorised, with the result being a category system for a specific context, such as context work [12] or

context cooking in private kitchens [13]. So while Hassenzahl (psychological needs) [4] or Desmet (positive emotions) [18] built on general psychological models, we use a more empirical and context-specific approach. For the context of work, there exist 17 experience categories that are sorted into 6 clusters (Table 3).

Table 3. Experience categories for the work context [12].

Cluster	Experience Category
Resonance	Receiving feedback Giving feedback Appreciation
Social support	Receiving help Helping others Teaching others
Challenge	Being given a challenge Rising to a challenge
Engagement	Solving a problem Experiencing creativity
Organisation	Keeping track of things Finishing a task
Communication and new experiences	Connecting with others Exchanging ideas Creating something together Experiencing something new Contributing to something greater

Compared with psychological needs theories, the concept of experience categories is rather new and unexplored. Psychological needs are well-researched and integrated into UX design processes; they are universal motivators of human behaviour and a trigger for positive feelings when psychological needs are fulfilled [15,19]. On the other hand, experience categories reflect positive experiences in the real world and refer to a certain context. The fact that our experience categories refer only to positive experiences is special. To the best of our knowledge, there is no further research on our positive experience category approach for specific contexts. To embed them more in existing theoretical models relevant in the field of positive UX, we want to investigate them more profoundly. As a first step, we want to find out which psychological needs drive which experience category.

In the current paper, we follow an approach from the general to the specific. In the first study, we worked with scenarios providing insights into all experience categories. These scenarios were rated with the German translation [15,20] of the needs questionnaire of Sheldon and colleagues [3] to find out which needs were assigned to each experience category.

In the second study, we used an existing dataset of positive experiences that had been collected when participants evaluated a prototype of a worker guidance system [21]. Two raters assigned each of these experiences to an experience category [12] and to a psychological need. Via a contingency table, we analysed which experience categories and which psychological needs occurred together. We wanted to find out if the results from the first could be replicated when focusing on a real dataset, and the same experience categories and needs co-occur as in Study 1.

2. Study 1—Assigning Psychological Needs to Experience Categories Using Scenarios

2.1. Theoretical Background

Experience categories are derived from collections of positive experiences in a certain context. The first set of experience categories was created for work contexts [12]. To use them in human-centred design processes, they were prepared as experience cards (see Figure 1). The experience card depicts information that was gathered from the analysis of

the experience interviews, which served as the basis for generating the experience categories: 'Must haves': attributes that are essential to design for this category; 'Optional': attributes that are optional to design for this category; 'Is experienced with': gives information about the nature of the persons who are experienced in these areas; 'Social index': describes to what extent the category is experienced with others.

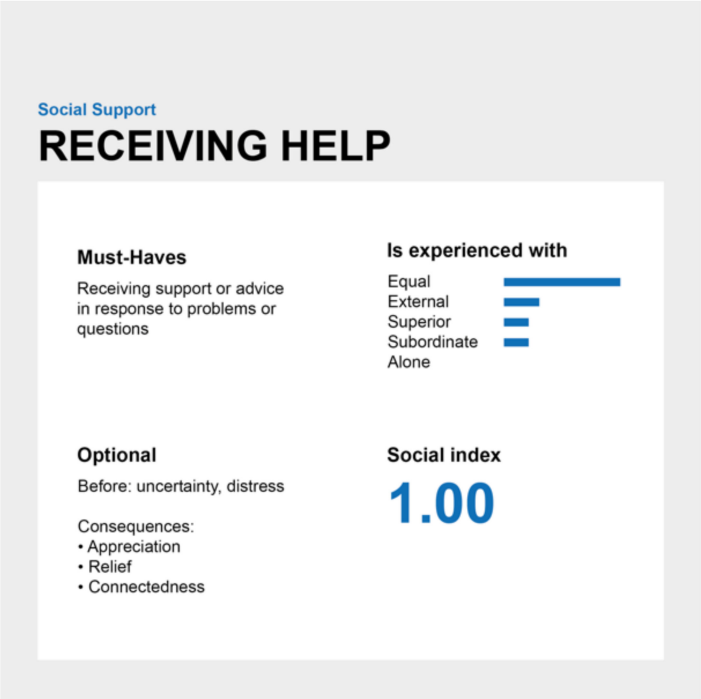

Figure 1. Experience card for experience category Receiving Help in the Social Support cluster based on Zeiner and colleagues [12].

The more we know about an experience category, the better we can use that information in design processes. Thus, our intention was to enrich the information we had with possible relations to psychological needs. In this first study, therefore, we *operationalised* experience categories as scenarios. The participants rated them with a need questionnaire to see which needs were assigned to which experience category.

2.2. Materials and Methods

2.2.1. Participants

The study participants were recruited via the email distribution list of Stuttgart Media University. In addition, the participants were recruited via posts on LinkedIn (https://www.linkedin.com/, accessed on 14 February 2022). The call for participation included a brief explanation of the study and a link to the online survey. The criteria for selecting participants for data analysis were that they were 18 years of age or older and had at least 1 to 2 years of professional experience.

A total of 96 subjects participated. The data of 26 participants were excluded from analysis because these individuals indicated that they had no professional experience, which was a requirement for data analysis. Thus, a total of 70 participants' data were included in the statistical analysis. Here, 51 of the participants identified as female, 17 as male, and 2 as diverse. The participants were between 19 and 63 years old (M = 26.81, SD = 8.13). Seven of the participants stated that their highest level of education was a secondary school diploma. Of the participants, 24 indicated that they obtained advanced technical college entrance qualifications, and 24 participants reported that they had obtained general qualification for university entrance. Twelve participants stated that they had obtained a bachelor's degree, and three participants reported having a master's degree

or a higher level of education. Here, 38 participants indicated 1 to 2 years of professional experience, 12 participants stated having 3 to 5 years of professional experience, and 10 participants reported 5 to 10 years of professional experience. Seven participants indicated having 10 to 20 years of professional experience, and three participants reported having more than 20 years of professional experience. Table 4 shows the industrial sectors in which the participants worked.

Table 4. Industrial sectors in which the participants worked.

Industrial Sector	*n*
Chemical and raw materials	1
Service and craft	2
E-commerce	3
Energy and environment	1
Trade and consumption	2
Internet, IT, and media	23
Advertising and marketing	15
Social	12
Other	11

The study was conducted as part of a bachelor's thesis and was supervised by employees of the Mittelstand 4.0-Competence Center Usability, which is part of the Mittelstand Digital initiative funded by the German Federal Ministry for Economic Affairs and Climate Action.

Part of the sample was students from the information and communication faculty of Stuttgart Media University. For participating, they received the credits they needed for their degree programme. Whether the participants were working in the queried industrial sector at the time of their participation was not explicitly asked (the question was 'In welcher Branche arbeitest du?'; in English, 'In which industry do you work?'). However, because many students at the Stuttgart Media University completed vocational training prior to their studies or had a part-time job in addition to their studies, it could be assumed that student participants indicated the industrial sector of their vocational training or part-time job.

The participants were not informed about the research questions prior to the study.

2.2.2. Materials

To determine which needs were most addressed in which experience categories, scenarios were formulated for each of the 17 experience categories. To investigate whether the scenarios reflected the experience categories in terms of content, a preliminary study was conducted with three experts for positive UX. All the experts regularly worked with the experience categories as part of their professional activities. In addition, one of the experts was involved in the development of the experience categories. For the preliminary study, the experts were presented with all scenarios in random order; they were asked to read the scenarios and then assign them to 1 of the 17 experience categories. To determine the experts' agreement in assigning the scenarios to the experience categories, inter-rater reliability was determined. Analysis revealed a high level of agreement, $\kappa = 0.96$. Because the results suggest that the scenarios reflect the experience categories, the scenarios were used as study material without modifications. The scenarios are listed in Appendix A, Table A1. To investigate which needs were addressed in the scenarios, the German translation [15,20] of Sheldon and colleagues' needs questionnaire [3] was used because there is no questionnaire yet on the updated psychological needs framework by Desmet and Fokkinga [8]. The questionnaire is based on the psychological theory of Sheldon and colleagues [3], according to which there are 10 basic psychological needs, most of which can be found in the Desmet and Fokkinga's framework [8] (see Table 2). For each need, three items with a 5-point scale (1 = not at all; 5 = very much) were used to measure the extent to which the needs were

addressed. All items represent responses to the sentence, 'During this event, I felt . . . ' For example, for the need for competence, the items were: 'That I was successfully completing difficult tasks and projects.', 'That I was taking on and mastering hard challenges.' and 'Very capable in what I did.'. The questionnaire comprised a total of 30 items. It is possible to select scales of needs suitable for the research question, so that not all the items have to be used. In the present study, it was decided to not present the items of the needs luxury and physical thriving because they were not relevant in the context of work. Thus, the participants were presented with a total of 24 items for each scenario.

The study was conducted online using the Unipark questionnaire tool (https://www.unipark.com/, accessed on 10 February 2022).

2.2.3. Procedure

At the beginning of the survey, the participants were informed about the data protection regulations and asked for their consent in this regard. After giving their consent, the participants were asked about their gender, age, highest level of education, the industrial sector in which they work, and their professional experience. After sociodemographic data had been collected, the participants were randomly assigned to one of two groups. In each group, a fixed selection of scenarios was presented. Group 1 was presented with nine scenarios, and Group 2 with eight scenarios. The division was performed in order to reduce the duration of the study and, thus, the workload of the participants. We assigned 33 participants to Group 1, and 37 participants to Group 2. Table 5 shows the distribution of the scenarios in the groups.

Table 5. Assignment of scenarios (listed in experience categories) to Groups 1 and 2 in the online survey.

Group	*n*	Scenario (Experience Category)
1	33	Receiving feedback Appreciation Helping others Being given a challenge Solving a problem Finishing a task Connecting with others Creating something together Contribution to something greater
2	37	Giving feedback Receiving help Teaching others Rising to a challenge Experiencing creativity Keeping track of things Exchanging ideas Experiencing something new

After being assigned to one of the two groups, the participants were informed of the following procedure. They were instructed that they would be given scenarios to read, each of which would take place in the context of the work. The participants were then asked to read through the scenarios calmly and to put themselves in the described situations. Afterwards, their task would be to fill in the given questionnaire, with no wrong answers possible.

After the instruction, the participants were given the scenarios of their respective groups in random order. Following each scenario, they were asked to complete the German translation [15,20] of Sheldon's needs questionnaire [3]. The participants were thanked for their participation after the evaluation of the scenarios had been completed and were bid farewell.

2.2.4. Analysis

When analysing the data for each experience category (scenario), the arithmetic mean of the eight needs scales was calculated first. Subsequently, per experience category (scenario), the mean scores were sorted according to their expression (high–low). The orders of the mean scores were then examined to determine which needs were the most strongly addressed by the respective experience category (scenario). The cut-off between the most and less strongly addressed needs was defined by the first significant drop in the mean score, starting from the highest mean score of the order. The statistical analysis of the data was performed using the statistical software SPSS Statistics (Version 28) by IBM. As the level of significance, 5% ($\alpha = 0.05$) was used.

2.3. Results

2.3.1. Checking Prerequisites: Examining Differences between the Two Groups

To determine if there were differences between Group 1 ($n = 33$) and Group 2 ($n = 37$) in age, a Mann–Whitney U test was calculated. The analysis shows that there was no statistically significant difference in age ($U = 548.00$, $Z = -0.738$, $p = 0.465$). To determine if there were differences in gender, the highest level of education and professional experience chi-squared tests were conducted. For gender, two expected cell frequencies were smaller than 5 because there were only two participants who identified themselves as diverse. However, because these two individuals were distributed between the two groups, no error was assumed in the results. For the highest level of education and professional experience, there were also some expected cell frequencies that were smaller than 5; therefore, some categories were combined into larger ones (highest level of education: combination of secondary school diploma and technical college entrance qualification, bachelor's degree, and master's degree of higher level; professional experience: combination of 3–5 and 5–10 years, 10–20 years, and more than 20 years). The results show no significant dependence between groups and gender ($\chi^2(2) = 2.840$, $p = 0.242$), groups and highest level of education ($\chi^2(2) = 1.958$, $p = 0.376$), and groups and professional experience ($\chi^2(2) = 0.059$, $p = 0.971$). Overall, it can be assumed that the two groups came from the same population.

2.3.2. Experience Categories and Needs

Wilcoxon tests were conducted to determine the needs that were most strongly addressed by each experience category. Table 6 shows the results of the descriptive analysis of the needs scales. Table 7 provides the test statistics of the Wilcoxon tests used to identify the drop in the mean ratings of the needs scales for each experience category.

Table 6. Descriptive statistics (arithmetic means and standard deviations) of the needs scales on the 17 experience categories.

			Autonomy		Competence		Relatedness		Meaning		Stimulation		Security		Self-Esteem		Popularity	
Cluster	**Experience Category**	***n***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
Resonance	Receiving feedback	33	4.11	0.72	4.72	0.33	3.16	1.11	3.54	0.89	3.68	0.83	3.55	0.91	4.61	0.59	4.67	0.49
	Giving feedback	37	3.05	0.96	3.05	84	3.40	0.70	2.84	0.87	3.50	0.73	2.72	0.80	3.40	0.78	3.68	0.83
	Appreciation	33	3.17	0.85	4.19	0.67	3.40	0.99	3.24	0.83	3.79	0.72	2.80	0.90	4.23	0.67	4.09	0.74
Social support	Receiving help	37	2.61	0.88	3.35	0.76	3.58	0.84	2.39	0.86	2.34	0.84	2.55	0.78	3.00	0.62	3.04	0.84
	Helping others	33	3.32	1.07	3.85	0.79	3.29	1.14	2.69	1.05	2.70	0.86	2.89	0.92	3.95	0.69	4.27	0.89
	Teaching others	37	3.89	0.85	4.05	0.79	3.52	0.80	3.20	0.99	3.89	0.80	3.04	0.78	4.07	0.66	4.55	0.69
Challenge	Being given a challenge	33	3.48	0.98	4.17	0.72	2.60	0.90	3.78	0.81	3.96	0.66	3.02	0.89	4.09	0.82	3.59	0.92
	Rising to a challenge	37	3.45	0.92	4.68	0.53	2.67	1.05	3.00	1.09	3.71	0.89	3.42	0.78	4.19	0.56	3.64	0.98
Engagement	Solving a problem	33	3.51	1.06	4.68	0.50	1.84	1.05	3.00	1.10	4.06	0.71	2.91	1.05	4.25	0.71	3.18	1.03
	Experiencing creativity	37	4.40	0.56	3.81	0.67	2.25	1.00	3.43	0.79	4.36	0.52	2.89	0.89	3.86	0.56	3.32	1.03
Organisation	Keeping track of things	37	3.54	0.67	4.40	0.56	2.17	1.00	2.64	0.89	2.89	1.03	4.06	0.52	3.58	0.56	2.98	0.79
	Finishing a task	33	3.41	0.96	4.54	0.74	1.82	1.02	2.79	0.94	2.77	0.98	3.97	0.60	4.10	0.59	2.69	1.12
Communication and new experiences	Connecting with others	33	3.75	0.70	3.35	1.12	3.76	0.79	3.62	0.87	4.42	0.62	3.01	1.02	4.21	0.60	4.01	0.60
	Exchanging ideas	37	3.71	0.65	3.84	0.90	3.65	0.90	2.87	0.88	3.10	0.91	3.23	0.76	3.64	0.71	4.02	0.68
	Creating sth. together	33	4.27	0.63	4.46	0.52	3.91	1.09	3.91	0.83	4.51	0.51	3.20	0.82	4.25	0.65	4.01	0.73
	Experiencing sth. new	37	3.86	0.77	3.63	1.01	2.05	1.02	2.92	1.06	3.92	0.74	3.56	0.86	3.46	0.93	2.83	1.15
	Contributing to sth. greater	33	4.14	0.72	4.43	0.61	2.80	1.19	3.69	0.94	3.88	0.89	2.99	1.02	4.25	0.64	4.34	0.71

Note: grey boxes highlight the needs that were the most strongly addressed by each experience category.

Table 7. Needs that were the most strongly addressed by the experience categories and test statistics of the Wilcoxon tests used to identify the drop in the mean ratings of the needs scales for each experience categories.

Cluster	Experience Category	*n*	Most Strongly Addressed Needs	Drop of Mean Score		
				Need [1]	*z*	*Asymp. Sign.*
Resonance	Receiving feedback	33	competence, popularity, self-esteem	autonomy	−3.80	<0.001
	Giving feedback	37	popularity, stimulation, self-esteem, relatedness	autonomy	−2.40	0.016
	Appreciation	33	self-esteem, competence, popularity	stimulation	−2.23	0.026
Social support	Receiving help	37	relatedness, competence, popularity, self-esteem	autonomy	−2.76	0.006
	Helping others	33	popularity	self-esteem	−1.43	0.007
	Teaching others	37	popularity	self-esteem	−1.43	<0.001
Challenge	Being given a challenge	33	competence, self-esteem, stimulation, meaning, popularity, autonomy	security	−2.90	0.004
	Rising to a challenge	37	competence	self-esteem	−3.86	<0.001
Engagement	Solving a problem	33	competence	self-esteem	−0.59	<0.001
	Experiencing creativity	37	autonomy, stimulation	self-esteem	−4.41	<0.001
Organisation	Keeping track of things	37	competence	security	−3.13	0.002
	Finishing a task	33	competence	self-esteem	−3.80	<0.001
Communication and new experiences	Connecting with others	33	stimulation	self-esteem	−2.44	0.015
	Exchanging ideas	37	popularity, competence, autonomy, relatedness, self-esteem	security	−2.85	0.004
	Creating sth. together	33	stimulation, competence, autonomy, self-esteem	popularity	−2.33	0.020
	Experiencing sth. new	37	stimulation, autonomy, competence, security, self-esteem	meaning	−4.23	<0.001
	Contributing to sth. greater	33	competence, popularity, self-esteem, autonomy	stimulation	−1.97	0.049

[1] First need whose score was significantly lower on average than those of the most strongly addressed needs.

The results of the analysis suggest that the experience categories of the Resonance cluster strongly addressed the needs for *self-esteem* and *popularity*. Experience categories Receiving Feedback and Appreciation each also highly addressed the need for *competence*. Experience category Giving Feedback also addressed the needs for *stimulation* and *relatedness*.

Furthermore, the results indicate that the experience categories of the Social Support cluster strongly addressed the need for *popularity*. In addition, experience category Receiving Help strongly addressed the needs for *relatedness*, *competence*, and *self-esteem*.

Moreover, the results suggested that the experience category Rising to a Challenge of the cluster Challenge most strongly addressed the need for *competence*. The second experience category of cluster Being Given a Challenge strongly addressed the need for *competence*, and the needs for *self-esteem*, *stimulation*, *meaning*, *popularity* and *autonomy*.

The results also indicate that experience category Solving a Problem of the Engagement cluster most strongly addressed the need for *competence*. Experiencing Creativity, the second experience category of the cluster, on the other hand, particularly addressed the needs for *autonomy* and *stimulation*.

The findings further indicate that experience categories Keeping Track of Things and Finishing a Task of the Organisation cluster most strongly addressed the need for *competence*.

Lastly, the results also indicate that experience category Connecting with Others of the Communication and New Experiences cluster most strongly addressed the need for *stimulation*. The four other experience categories of the cluster each strongly addressed the needs for *autonomy*, *competence*, and *self-esteem*. Experience category Exchanging Ideas also strongly addressed the need for *popularity* and *relatedness*. Experience category Creating Something Together additionally addressed the needs for *stimulation*, and experience category Experiencing Something New further addressed the needs for *stimulation* and *security*. Experience category Contributing to Something Greater also strongly addressed the need for *popularity*.

2.4. Discussion

The present study presented which needs were assigned to scenarios that describe situations in the professional context that are typically experienced positively according to experience categories [12]. The key findings of the study can be summarised as follows:

- Resonance cluster: all of the experience categories strongly addressed the needs for *self-esteem* and *popularity* (i).
- Social Support cluster: All of the experience categories strongly addressed the need for *popularity* (ii).
- Challenge cluster: All of the experience categories strongly addressed the need for *competence* (iii).
- Engagement cluster: Experience category Solving a Problem most strongly addressed the need for *competence*. Experience category Experiencing Creativity strongly addressed the needs for *autonomy* and *stimulation* (iv).
- Organisation cluster: All of the experience categories most strongly addressed the need for *competence* (v).
- Communication and New Experiences cluster: Except for Connecting with Others, all of the remaining experience categories strongly addressed the needs for *autonomy*, *competence*, and *self-esteem* (vi).

The results further indicate that many experience categories were simultaneously assigned to multiple needs to a similar extent (e.g., Receiving Feedback or Being Given a Challenge). This was not surprising, because an experience is not one-dimensional, but rather consists of multiple facets. On the other hand, the results indicate that there are seven experience categories (e.g., Helping Others or Finishing a Task) that particularly addressed a single need. The experiences of those categories might be more focused on a single need.

Moreover, the results suggest that the experience categories of the same cluster often overlapped regarding the needs that they addressed most strongly (i–iii, v, vi). This result supports the cluster classification by Zeiner and colleagues [12]. Only the two experience categories of the Engagement cluster showed no overlap in the most strongly addressed needs (iv). Even when both categories (Solving a Problem and Experiencing Creativity) were associated with great engagement (after which the cluster is named), the focus in these activities was quite different which might be explain the differences in their underlying needs.

In contrast, the definitions of the needs [3] most strongly addressed in each of the clusters (i–iii, v, vi) exhibited a high degree of similarity to the descriptions of the respective experience categories. Thus, the needs for *self-esteem* and *popularity* were strongly addressed in all experience categories of the Resonance cluster (i). As the name suggests, all of the experience categories in the Resonance cluster referred to situations in which people shared or received some kind of evaluation. Thus, these situations offered great potential to satisfy the striving for feeling worthy, which constitutes the need for *self-esteem* [3]. In addition, the experience categories fit with the definition of the need for *popularity*, which is to be liked and to be someone whose opinion matters. The need for *popularity* was strongly addressed by all experience categories in the Social Support cluster (ii). The experience categories of this cluster are also situations in which a positive influence on other people can be experienced, thus corresponding to the need's definition.

In each experience category of the clusters Challenge (iii) and Organisation (v), the need for *competence* was strongly addressed. According to Sheldon and colleagues [3], competence is the need to feel highly effective and capable. The experience categories of the Challenge cluster reflect the aspect of the definition of being capable because these are situations in which a person is expected to perform challenging tasks and master them. The aspect of effectiveness, on the other hand, was found in the experience categories of the Organisation cluster because these are part of successful goal attainment.

With the exception of experience category Connecting with Others, all experience categories of the Communication and New Experiences cluster overlapped in strongly

addressing the needs of *autonomy*, *competence*, and *self-esteem* (vi). The definition of the need for *competence* (feeling effective and capable) [3] was found in the experience categories because these describe situations in which something is worked out or a person broadens their perspective. Furthermore, working out or discovering new things alone or together also comes along with feeling worthy and on par with others, which constitutes positive *self-esteem*. The definition of the need for *autonomy*, according to which one is the initiator of one's own actions [3], can also be found in the experience categories because they involve very active situations. For example, the scenario of experience category Creating Something Together describes a situation in which a person's idea for founding a start-up is concretised by convening a first meeting in which there is active work on the ideas, tasks and distribution of roles (see Table A1). Experience category Connecting with Others further overlapped with experience categories Creating Something Together and Experiencing Something New of the 'Communication and New Experiences cluster in strongly addressing the need for *stimulation*. Stimulation, according to Sheldon and colleagues [3], is the sensation of pleasure and joy, and the absence of boredom. The three experience categories in which stimulation was strongly addressed represent situations in which people come into contact or new things are experienced, thus reflecting this definition.

The correspondence in content between the needs definitions [3] and the clusters of the experience categories [12] that most strongly addressed the respective needs suggests that the results of the current study are consistent with what might be expected. However, apart from the needs that are consistently addressed in the clusters, there were some noticeable results when considering the additional needs that the individual experience categories (or did not) addressed.

For example, *security* was not among the most strongly addressed needs in either the Keeping Track of Things or the Finishing a Task experience category of the cluster Organisation. Although the need for security was addressed in both experience categories, the need for competence seemed to be significantly more relevant. This result was remarkable because both experience categories represented situations in which processes were structured and provided certainty, for example, in goal achievement, which characterises *security* [3]. Although these two aspects are part of the scenarios (Table A1), it is possible that the need for security is particularly pronounced if a person identifies sufficiently with tasks and feels responsible for them. Both scenarios, however, are hypothetical situations that, depending on the occupational area, may not occur in this same way in the participants' jobs. Furthermore, both scenarios involve descriptions of stressful situations that might impair a feeling of security. All of this may have contributed to the fact that the need for security was not addressed as expected in the two experience categories. Interestingly, the need for *security* was only once found to be among the most strongly addressed needs in the entire study, namely, in experience category Experiencing Something New, even though the mean values were below those in the Organisation cluster. The results for this experience category were among those showing the least differentiated picture because many needs were addressed to roughly similar degrees. This could possibly be attributed to the fact that the respective scenario was not limited to describing how something new is learned, but that it also depicted the familiarisation with new software and planning further steps (Table A1).

Another striking result is that *competence* was one of the most strongly addressed needs in the experience category Receiving Help. This is interesting because a situation in which a person needs assistance does not seem to be perceived as an expression of incapability. This may be explained by the fact that a person is perceived and might feel capable when they are entrusted with many different tasks, because this indicates they are believed to have mastered them. This assumption can be supported by the fact that the experience category also particularly addresses the need for *self-esteem*. In addition, the scenario described a situation in which there is no need for professional help but for relief in the number of tasks (Table A1). Thus, in this case, the professional qualifications of the person are not questioned.

A further interesting result is that the need for *relatedness* was not strongly addressed by experience category Connecting with Others. The reason for this might be that the items of the scale for measuring the need for relatedness capture close and very familiar social interactions [3]. The situation described in the respective scenario might have contributed to these results because it was about an encounter with people who know each other only in passing.

Furthermore, experience category Contribute to Something Greater did not seem to be particularly associated with the need for *meaning*. This result may be attributed to the items of the questionnaire of Sheldon and colleagues [3], and the items of the meaning scale refer to the feeling of meaning at a higher level and the big picture. It is possible that the impact of the actions described in the corresponding scenario was not perceived as far-reaching or significant enough.

Overall, it can be concluded that scenarios should be carefully prepared when they are used to investigate the relationship between experience categories and needs. First, it should be ensured that the content of the research materials is limited to the core of the respective experience category. Those aspects that form more of a frame story should be avoided in order to obtain differentiated results. Moreover, it should be ensured that participants can sufficiently empathise with the material used to investigate the experience categories by, for example, placing them in situations that also occur in their everyday working lives. In addition, the participants should be exposed to all experience categories multiple times to ensure that their respective needs are captured across different study units.

Nevertheless, the results show which needs mainly drove an experience in a certain context, thus enriching the empirical knowledge we already have about experience categories (as depicted on the experience cards; see Figure 1).

In the next study, we expanded the examination of the relationship between experience categories and psychological needs. However, the focus of the subsequent study was on a certain work context to determine whether the results of the first study could be replicated in a specific work context.

3. Study 2—Relation between Experience Categories and Psychological Needs in the Context of Assembly

3.1. Theoretical Background

The valence method [22,23] is an instrument for the formative evaluation of user experience (UX). The method can be divided into two phases. In the first phase, the so-called *explorative use*, the participants are given two tasks. First, they are asked to freely explore the system whose UX is to be evaluated. They do not have a specific task to work on with the system. Instead, they are invited to explore it according to their own interests. The second task is to document any positive or negative feelings triggered by the interaction with the system. Positive or negative feelings can be indicated directly by pressing (virtual) positive or negative buttons that are then documented as positive or negative value markers in the video. The exploration of the system and the valence markers are videotaped. In the second phase of the valence method, so-called *retrospective interviewing*, the participant and the experimenter watch the video together. Whenever there is a valence marker in the video, the video is stopped and the participant is interviewed about it. The interview is used to determine which design element triggered the positive or negative feeling and what personal significance it has for the participant. To identify the underlying needs of a positive experience, a special interview technique is used, laddering [24], which can be integrated in the valence method interview methodology [25]. The ladder technique allows for an interviewer to delve deeper into a respondent's statement, essentially by asking a series of "why?" questions [24]. In further data analysis, the findings from the interviews are then used to assign psychological needs to the collected experiences (represented by valence markers). However, when the valence method is applied in a context where a set of experience categories already exist, these can also be assigned to the observed experiences [25]. Figure 2 shows the procedure of the valence method.

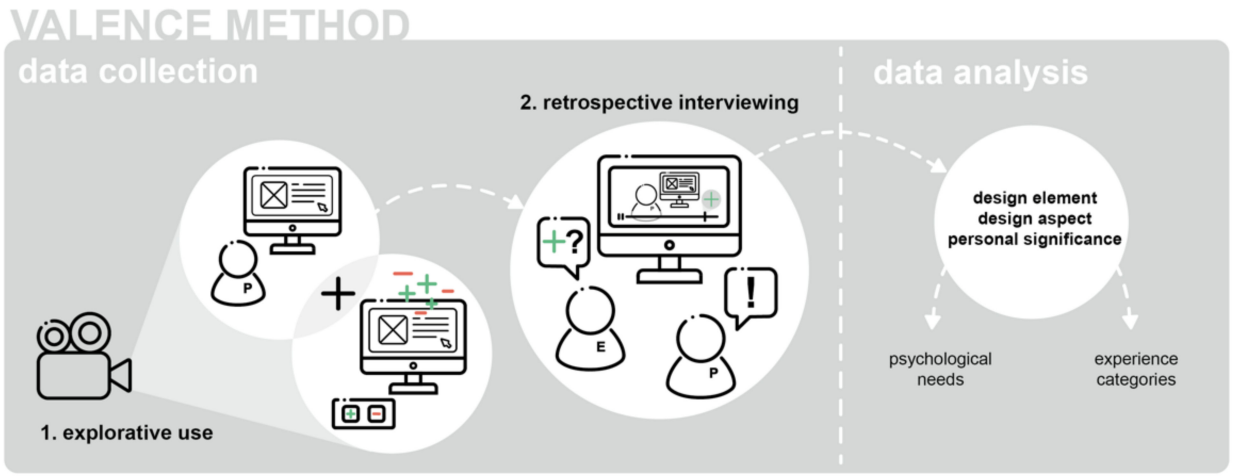

Figure 2. Schematic procedure of the valence method. Green plus signs represent positive valence markers; red minus signs represent negative valence markers. P, participant; E, experimenter.

In Study 2, the experiences collected when participants evaluated a prototype of a worker guidance system (WGS) used in assembly with the valence method were analysed [21,26]. WGS are cognitive assistance systems that provide employees with information about individual work steps; they are integrated into the work environment [27,28]. By assigning both psychological needs and experience categories to each experience, we gained a considerable dataset that allowed for us to calculate the relationships between psychological needs and experience categories in a specific work context.

3.2. Materials and Methods

3.2.1. Participants

Through the website and social media channels of the Mittelstand 4.0-Competence Center Usability, a call for participation was distributed. Those participants who had responded to the call were screened via mail for eligibility. Participation required a minimal age of 18 and experience in industrial assembly.

Ten subjects participated. Two of the participants indicated that they were female and eight as male. The participants were 19 to 58 years old (M = 35.90, SD = 14.70). Three of the participants reported a high-school diploma as their highest level of education. Three participants indicated that they had completed vocational training, and four participants reported having a university degree. On average, the participants had 7.9 years (SD = 7.96) of professional experience. An overview of the distribution of professional experience can be found in Table 8.

Table 8. Professional experience distribution among the participants.

Years of Professional Experience	*n*
0	3
1	1
9	1
10	2
12	2
25	1

The study was conducted by the Mittelstand 4.0-Competence Centres Usability and Darmstadt, which are part of the Mittelstand-Digital initiative funded by the German Federal Ministry for Economic Affairs and Climate Action.

Participants received EUR 50 for their participation and a voucher for the online store of the technical university of Darmstadt. The participants were not informed about the research questions prior to the study.

3.2.2. Materials

To determine how the needs and experience categories were related, a prototype of a WGS was used. WGSs are used in the context of industrial assembly to assist workers in assembling products by providing assembly-based information [27–31]. The prototype consisted of on-screen displays for tablets that provided the worker with information about which assembly components to use and how to perform the assembly steps. The prototype was based on an interface of an available WGS on the market, which we extended with concepts for positive experiences [26]. In order to develop the concepts for positive experiences, we initially examined the WGS using an updated version experience potential analysis [26]. This method can be used to systematically narrow down which of the 17 experience categories have a high potential to lead to a positive experience when interacting with the investigated system or product. On the basis of the results of the experience potential analysis, which indicated a high potential of five experience categories (Receiving Feedback, Being Given a Challenge, Keeping Track of Things, Finishing a Task, And Creating Something Together), we developed a total of ten concepts for positive experiences. The concepts were implemented in a limited interactive prototype using Figma (https://www.figma.com, accessed on 19 November 2020). The concepts and a detailed description of the methodological approach to the development of the prototype can be found in [21].

The prototype was evaluated using the videoconferencing tool Zoom (https://zoom.us, accessed on 8 January 2021). The participants were provided with the prototype in Figma. In Figma, the participants had the opportunity to document the feelings that the prototype triggered in them via a virtual keyboard. A red minus button could be used to document negative feelings (negative valence marker) and a green plus button could be used to document positive feelings (positive valence marker). Figure 3 shows the prototype of the WGS embedded in Figma and the virtual keyboard for documenting the valence markers.

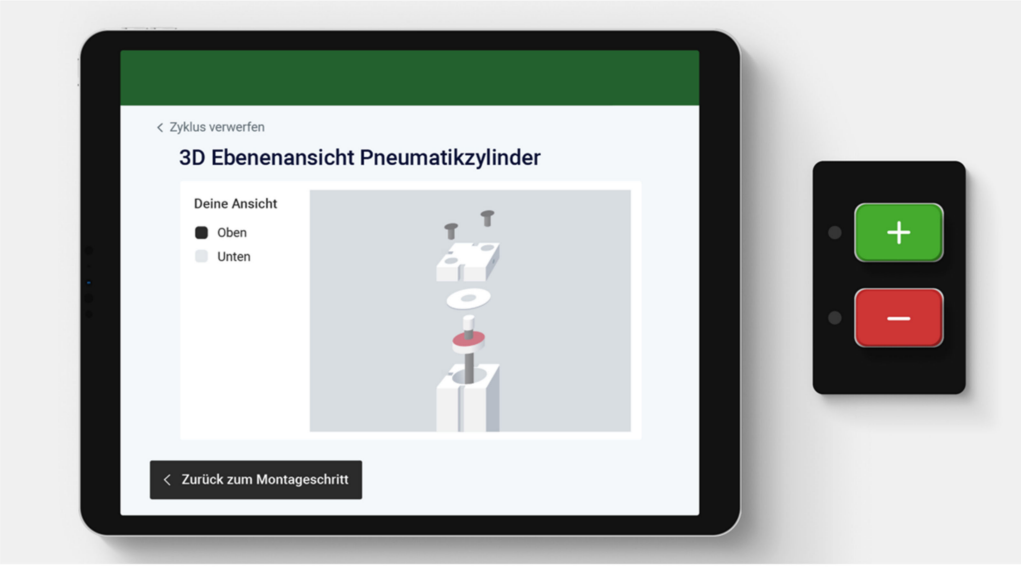

Figure 3. Screenshot of the test setup. In the centre, there is a screen of the prototype of the worker guidance system (WGS) placed on an animated tablet. To the right of the tablet there is a virtual keyboard with a green plus button and a red minus button.

3.2.3. Procedure

The participants were invited by mail to a Zoom meeting. Prior to the appointment, they were informed in written form about the privacy policy, and their consent to it was obtained. At the beginning of the appointment, the participants were welcomed and informed about the procedure. The participants were instructed that they would be presented and interact with a prototype of a WGS. They would have the task of exploring

the prototype while documenting their feelings about it. To document their feelings, they would use the red button on a virtual keyboard if the prototype triggered a negative feeling in them, and the green button whenever they had a positive feeling. The participants were asked not to evaluate the system itself and were instructed not to comment during the exploration of the prototype because an in-depth interview on the documented feelings would follow in the second part of the study.

After instruction, an introductory interview was conducted in which the participants were asked to describe their current professional situation and their previous experience with WGS. Subsequently, they received a link to a survey on questionnaire tool Unipark for the collection of sociodemographic data. Following this, the participants were provided with the prototype in Figma and were asked to share their screen with the experimenter, so that the experimenter could observe and record the interaction.

After completing the exploration of the prototype, the recording was played to the participants. For each valence marker, the video was paused, and the participants were interviewed about it. The interview was used to determine which design element (e.g., log-in text 'Good morning [name of user]') and aspect (e.g., personal address) triggered the positive or negative feeling and where the personal meaning. (e.g., feeling appreciated) rested in it for the participant. After the interview had been completed, the participants were thanked and bid farewell.

3.2.4. Expert Evaluation

To analyse the results, the indepth interviews were first transcribed. Then, for each valence marker, the literal statement, timestamp of the statement, valence (positive/negative), mentioned design element, and design aspect were extracted and transferred into a table. After the data had been processed, they were independently analysed by two UX experts (authors of the current study). To this end, the two experts first familiarised themselves intensively with the needs defined by Desmet and Fokkinga [8], and the experience categories by Zeiner and colleagues [12]. In multiple iterations, the experts then assigned each valence marker to an experience category and analysed which of the 13 needs from Desmet and Fokkinga's model [8] were met or not in the experience. First, the experts evaluated part of the data and exchanged information about their approach. By discussing their initial experiences, a common understanding of the interpretation of valence markers was achieved. Subsequently, already analysed data were reviewed, and the remaining valence markers were evaluated.

To validate the experts' agreement in assigning the valence markers to the experience categories and for the analysis of the underlying needs, inter-rater reliability was determined. The results indicate that the experts substantially agreed in assigning experience categories, $\kappa = 0.76$. The experts also agreed substantially on the analysis of underlying needs, $\kappa = 0.70$. Lastly, to investigate the relationship between the experience categories and needs, the experts jointly assigned each valence marker to an experience category and an underlying need by first marking all discrepancies between their assignments of valence markers to experience categories and needs in the dataset. The experts then jointly reviewed each discrepancy and discussed the final assignment. The definitions of needs according to Desmet and Fokkinga [8], and experience categories according to Zeiner and colleagues [12] were used to support the decision making.

3.2.5. Analysis

Analysis of the data was performed using statistical software SPSS Statistics (Version 27) by IBM. Data from all participants were included in the analysis.

A contingency table was used to evaluate the relationship between experience categories and needs (see Table 9). In total, the assignment of 94 valence markers was examined.

Table 9. Contingency table of assigned experience categories and needs in Study 2.

	Needs						
Experience Category	**Autonomy**	**Competence**	**Impact**	**Purpose**	**Recognition**	**Stimulation**	**Total**
Receiving feedback	0	8	3	0	1	0	12
Appreciation	0	0	0	0	7	0	7
Rising to a challenge	0	1	0	0	0	0	1
Being given a challenge	0	7	0	0	0	0	7
Solving a problem	1	0	0	0	0	0	1
Experiencing creativity	2	0	0	0	0	0	2
Finishing a task	0	2	2	0	0	0	4
Keeping track of things	0	45	0	1	0	0	46
Creating sth. together	0	0	1	0	0	0	1
Experiencing sth. new	0	3	0	1	0	4	8
Contributing to sth. greater	0	0	5	0	0	0	5
total	3	66	11	2	8	4	94

3.3. Results

The analysis indicates that most of the valence markers (n = 46) were assigned to experience category Keeping Track of Things. For 45 of these valence markers, *competence* was identified as the underlying need. Here, 12 valence markers were assigned to experience category Receiving Feedback, of which eight were associated with the need for *competence*, and three with the need for *impact*. Eight valence markers were assigned to experience category Experiencing Something Greater. Analysis of the underlying needs revealed that, for four of these valence markers, the underlying need was *stimulation*, while for three it was *competence*. Seven valence markers were assigned to each of experience categories Appreciation and Being Given a Challenge. While the underlying need of all valence markers in the Appreciation category was *recognition*, the underlying need of all valence markers in the Being Given a Challenge category was *competence*. Five valence markers were assigned to the Contributing to Something Greater experience category, for all of which *impact* was identified as the underlying need. Four valence markers were assigned to the experience category Finishing a Task, of which the underlying need was *competence* on two occasions, and *impact* on the other two occasions. Two valence markers were assigned to experience category Experiencing Creativity, for all of which *autonomy* was identified as the underlying need.

3.4. Discussion

In the current study, the relation between experience categories and psychological needs was examined in a certain work context, namely, in the interaction with WGS in assembly processes. The key findings of the study can be summarised as follows:

- In total, there were 94 positive experiences when interacting with the WGS prototype.
- Of a total of 17 experience categories, 11 were experienced during interaction with the WGS prototype.
- Of a total of 13 needs, 6 were met or not during the interaction with the WGS prototype.
- The most frequently experienced categories were Keeping Track of Things (experienced 46 times), Receiving Feedback (experienced 12 times), Experiencing Something New (experienced eight times) and Being Given a Challenge (experienced seven times).
- The most frequent underlying needs were *competence* (66 times), *impact* (11 times), and *recognition* (eight times).
- The results are largely consistent with those from Study 1.

The results show that the Keeping Track of Things experience category with the underlying need for *competence* occurred most frequently during the interactions with the prototype. Experience category Receiving Feedback with the underlying needs for *competence* and *impact* occurred significantly less frequently, but still often. Experience

category Experiencing Something New occurred repeatedly in conjunction with the needs for *stimulation* and *competence*. In addition, experience categories Appreciation, with the underlying need for *recognition*, and Being Given a Challenge, in association with the need for *competence*, were experienced several times. Experience categories Rising to a Challenge, Solving a Problem and Creating Something Together were each experienced only by some participants.

The results of the second study show a high overlap with the results of Study 1: except for experience categories Solving a Problem and Creating Something Together, in Study 2, at least one need was assigned to each of the experience categories that was most strongly addressed by the respective experience categories in the scenarios of Study 1 (see Table 10). This validates the findings concerning the relationship between experience categories and needs from Study 1, but in a more realistic context. In addition, for experience categories that were similarly associated with multiple needs in Study 1, the results of Study 2 expand the understanding of which of these needs may be more relevant.

Table 10. Comparison of the needs assigned to experience categories in Studies 1 and 2.

Experience Category	Most Strongly Addressed Needs—Study 1	Identified Needs—Study 2
Receiving feedback	competence, popularity, self-esteem	competence, impact, recognition
Appreciation	self-esteem, competence, popularity	recognition
Rising to a challenge	competence	competence
Being given a challenge	competence, self-esteem, stimulation, meaning, popularity, autonomy	competence
Solving a problem	competence	autonomy
Experiencing creativity	autonomy, stimulation	autonomy
Finishing a task	competence	competence, impact
Keeping track of things	competence	competence, purpose
Creating sth. together	stimulation, competence, autonomy, self-esteem	impact
Experiencing sth. new	stimulation, autonomy, competence, security, self-esteem	competence, stimulation, purpose
Contributing to sth. greater	competence, popularity, self-esteem, autonomy	impact

Note: matching needs (according to Table 2) are highlighted with grey boxes.

However, some of the results were based on the experiences of a single participant or small number of participants. Furthermore, for experience categories Solving a Problem and Creating Something Together, there was no agreement with the results of Study 1. Therefore, the results should be complemented with findings from further studies, especially in realistic contexts. Further research should also specifically aim to gain insights into the six experience categories that did not occur in Study 2.

4. General Discussion

The two studies investigated the relationship between experience categories and psychological needs. To this end, the first study used Sheldon and colleagues' needs questionnaire [3] to analyse which needs were the most strongly addressed by scenarios reflecting experience categories. The second study then validated the results of the first study using interview data from interactions with a real prototype of a WGS that was designed for positive user experiences.

The intention was to expand our knowledge of the experience categories for work contexts to enrich the information that can be used in design processes. This endeavour was successful for 9 of the 17 experience categories (Receiving Feedback, Appreciation, Rising to a Challenge, Being Given a Challenge, Experiencing Creativity, Finishing a Task, Keeping Track of Things, Experiencing Something New, and Contributing to Something Greater). For them, both studies demonstrated the same relationships with psychological needs.

This is illustrated in Table 10. We can now use this information to provide designers with more information about experience categories that might be helpful in the human-centred design process.

It was no surprise that, according to the results, the need for competence was particularly pronounced in the work context because it was related to many experience categories. Furthermore, the results of Study 1 also suggest that the need for *self-esteem* plays a relevant role. We only looked at one particular work context, namely, industrial assembly. Further studies should examine whether this also holds true in other work contexts. In addition, the prototype used in Study 2 had some limitations (see below).

However, the results do not only enrich the information about experience categories. These results can also render psychological needs more practically applicable. Knowing which needs are particularly addressed by which experience categories provides further assistance in designing for positive experiences in the work context. If, for example, which needs are particularly pronounced in a certain context is known, the selection of experience categories that are suitable for fulfilling the corresponding needs can be facilitated. In this way, positive experiences can be designed in a more systematic and targeted way.

The studies had certain limitations: (i) The scenarios of the first study described just one experience of a certain experience category. To expand the variety of experiences, different descriptions should be prepared to improve the operationalisation of one experience category. (ii) In the first study, most of the participants stated that they worked in the industrial sector of Internet, IT, and media. Further studies should aim for a broader sample in terms of the industrial sectors in which the participants work. This may mitigate the possible effects of individual differences in psychological needs. (iii) Multiple collections of psychological needs exist. We focused only on those by Sheldon and colleagues [3], and Desmet and Fokkinga [8]. Further studies should systematically replicate the results of the current study using other need models. (iv) With the second study, we contextualised the results of the first, more general study. However, this view is limited to one context. Future studies should replicate the findings in other contexts. (v) The results of Study 2 indicate that most positive experiences were related to the need for *competence*. Some needs, however, such as *autonomy* or *stimulation*, were only related to a few individual experiences. This can possibly be attributed to the fact that the concepts for positive experiences were developed only for 5 out of 17 experience categories when designing the WGS prototype [21]. This may also have restricted the diversity of the addressed needs. Therefore, future research should investigate the relationship between needs and experience categories in more realistic work contexts using study material that includes all 17 experience categories.

With the increase in mental stress because of digitalisation [32], the need to design positive experiences in the context of work is becoming increasingly important. Studies indicated that positive experiences can help in increasing people's motivation [33] and resilience [34]. In addition, there are studies that suggested that positively experienced software is used preferentially [18]. In this way, positively designed software could help companies in mastering some of the current challenges in the working world. Therefore, gaining more and profound knowledge about the methods we use is essential.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Scenarios of the experience categories (Study 1).

Cluster	Experience Category	Scenario
Resonance	Receiving Feedback	On the way to work, you became increasingly nervous. You had been working on a plan for a project for two months. When you arrived at the office, you went straight to your boss, opened your laptop, and presented the project plan to her. Afterwards, your boss looked at you and told you that she was not only excited about the project planning, but also about your presentation. She praised your precise and efficient way of presenting, and asked you to share your tips and tricks for creating and delivering presentations with the team. In addition, your project now waits in the wings.
	Giving feedback	You have been supervising an intern for two months. Yesterday, you were in a meeting with colleagues to discuss new features of your product. When you could not agree on how to proceed, your intern took the initiative and made a suggestion. The team accepted his proposal. Right after the meeting you let him know how impressed you were with his short presentation and initiative, that he should keep it up and that you look forward to his future input.
	Appreciation	Next month, you have a new project coming up with one of your company's most important customers. In your weekly team meeting, your colleague expresses that she needs another person on board to support her in this project. Your boss thinks you would be perfect for this role and you accept happily. After the meeting, your colleague approaches you and says, "I am really excited to have you on board".
Social support	Receiving help	Your colleague has called in sick, so this week you have to take care of the submission of a project at the end of the week by yourself. Your workload has doubled and you have to familiarise yourself with your colleague's documents. The next day, your boss asks you to finish another task by the end of the week. One of your colleagues overhears your boss' request and offers to take over the task because she knows on how much you already have to work this week. You express your gratitude for her support and attention.
	Helping others	You overhear one of your colleagues being upset. You find out that he struggles working with Excel. Since you have struggled with Excel several times, you have him explain to you where exactly the problem lies. In fact, you are able to identify the problem and explain to him how to solve it. You also show him your favourite website to visit when you become stuck with Excel.
	Teaching others	You attend training in which you learn about new research techniques. These techniques seem to be very promising, so you study them in order to be able to introduce them to your team. You offer your team a workshop about what you have learned that you prepare meticulously. In the workshop, you start with a short warm-up and then explain the new techniques. Afterwards, your colleagues are divided into groups, and each group tries one of the techniques. In the end, you discuss how to integrate these techniques into your daily work. Your colleagues are enthusiastic.

Table A1. *Cont.*

Cluster	Experience Category	Scenario
Challenge	Being given a challenge	Your boss approaches you and asks you to take on a new task. You are supposed to handle inquiries from new customers in the future and communicate them with her. At first, you are in doubt as to whether you are the right person for the job because you have never interacted with customers before. The next day, you sit down and start considering the steps you need to take. You notice that your affinity for organising would be beneficial for this task and that your communication skills would be helpful in dealing with customers. Slowly, you start to realise why your boss has entrusted you with this task.
	Rising to a challenge	You have been given the task of familiarising yourself with a new machine so that you can process the first job with it a week later. You have never worked with this type of machine before, which makes you feel a bit insecure at first. Because you only have one week to learn the ropes, you decide to set up a schedule. During this week, you keep coming across complicated functions that cost you more time than expected. However, due to your perseverance and planning skills, you stay on track so that you are actually able to start working on the sales order without any problems. Your boss comes to you after two weeks and says: "I knew you could do it".
Engagement	Solving a problem	Your company has ordered new machines, one of which belongs to your area of responsibility. The machine must be set up and equipped with individual components from your company. As soon as you start reading, you realise how complex this machine is. While testing the first functions, you repeatedly stumble over small problems. However, you are able to solve them by your experience and a little bit of fiddling. While setting up the machine, you do not even notice how fast the time goes by and look forward to the next working day. After a week, you have the machine running for the most part and you are impressed by your work.
	Experiencing creativity	Your boss thinks the company website needs to be more modern to appeal to a younger audience. You ask her to take over the redesign because you spend a lot of time on new trends in your private life. It is not a task that you have to complete urgently, so you can decide for yourself when to work on it. As you start to jot down your first ideas, you realise how many possibilities you have and you come up with one idea after another. You enjoy working on the redesign so much that you repeatedly lose yourself in the task for the next few weeks.
Organisation	Keeping track of things	You are facing an exhausting month. Your colleague has gone on maternity leave, so you have to take over a large part of her tasks. On your first day at work without your colleague, you use a task management tool to list all the upcoming tasks. You sort them by importance and add a deadline to each task. In this way, you can easily see which tasks are pending and you realise that the month will not be as exhausting as you expected.
	Finishing a task	As you have a number of deadlines and tasks coming up this week, you expect some exhausting days. On Monday, you already feel that you are not making any progress, so you create a to-do list. Over the next few days, you tick off more tasks on your to-do list and realise that you are progressing better than expected. Despite the numerous appointments, at the end of the week, you have completed all the tasks.

Table A1. *Cont.*

Cluster	Experience Category	Scenario
Communication and new experiences	Connecting with others	You are on your way to a professional development program. You are looking forward to the new input you will receive. After arriving you take a free seat and the training begins. During the first break, you are approached by one of the people sitting next to you, and you exchange ideas about your professions and the content of the training. You decide to have lunch together, to which you are accompanied by other participants. On the way home, you realise how satisfied you are. Not only did you receive new input through the training, you also gained experience through new encounters.
	Exchanging ideas	One of your colleagues expressed some concerns about the upcoming collaboration with another team from your department in a team meeting. Since you had already had similar thoughts, you decide to approach her about it after the meeting. During your conversation, you find out that your opinions are very similar. To facilitate everyone's collaboration and to counteract your doubts, you decide to develop a collaboration concept together. You both notice that you have benefited from this exchange.
	Creating something together	For some time, you have had the desire to found a start-up together with two former colleagues. You decide to have a kick-off meeting and spend a whole day generating ideas, assigning tasks and roles. By the end of the day, you have a big list of tasks and are already a great step closer to launching your start-up. The next time you meet, you realise how much you have already accomplished together in such a short time, and you look forward to your upcoming tasks.
	Experiencing something new	You have signed up for several exciting training sessions and conferences this year. At the first conference, you learn about some new trends and tools. Since you like to integrate new ideas into your daily work and you have been looking for a new management tool for a while, you check out one of the tools mentioned at the conference. After watching a few videos, you feel well-informed enough to set up the management tool the very next day. You can also use it to create a list of other new tools that you would like to implement in the future.
	Contributing to something greater	You are working for an online fashion store. You regularly read the feedback from your customers and notice that there are a lot of bad reviews about the amount of plastic in the parcels. You order a package yourself and are horrified to find out that the customers are right. The next day, you report the customers' reaction to the managers. The managers approve your idea of a task force to ensure that the online store uses more environmentally friendly packaging in the future. Several meetings and months later, the packaging is more environmentally friendly and contains less plastic. This change has been noticed by the customers, so there is a lot of positive feedback. This way you have not only done something good for the customers, but also for the environment.

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