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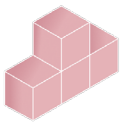

CHALLENGES OF DOWNSCALING AND UPSCALING IN HUMAN-CENTERED DESIGN

SIMON NESTLER
FAKULTÄT INFORMATIK
TECHNISCHE HOCHSCHULE INGOLSTADT
ESPLANADE 10
D-85049 INGOLSTADT
SIMON.NESTLER@THI.DE

SVEN QUADFLIEG
HAMM-LIPPSTADT UNIVERSITY OF APPLIED SCIENCES
DR.-ARNOLD-HUECK-STRASSE 3
D-59557 LIPPSTADT

KLAUS NEUBURG
OSTFALIA HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN
KARL-SCHARFENBERG-STRASSE 55-57
D-38229 SALZGITTER

ABSTRACT

Design has power – to improve lives, to empower people and to break down barriers. Successful design requires (besides many other tasks) a comprehensive analysis and deep understanding of the target audience. However, current design approaches, for instance established in the field of Human Centered Design, lead to multiple biases: Design neglects a multitude of needs when it uses downscaling to make complex target groups manageable. Downscaling must therefore disproportionately consider special needs within the design process – and upscaling must be able to compensate these biases again. The approach presented in this paper delivers three benefits: Conflicts between general and specific requirements are resolved, efficiency and equity are given equal consideration, and synergies become possible even at the resource level. By systematically analyzing and linking the issues of downscaling and upscaling in the context of design processes, the paper provides guardrails; these guardrails guide the design process and support a better focus to the general and specific needs of the target group.

INTRODUCTION

Design is a powerful tool: it can improve lives, empower people, and break down boundaries and barriers. At the same time design can also discriminate and exclude by simply not working for everyone or even manifesting or reinforcing existing sexism, racism or existing discrimination. A key to design that does not discriminate or exclude anyone is strongly linked to the idea of usability and accessibility. This concept is linked to the idea of usability and accessibility: Good usability and accessibility should guarantee that artifacts and processes can be used equally well by all users.

In Germany, the topic of UUX (Usability and User Experience) is currently receiving growing attention. One of the triggers is the BITV[1], which defines legal

[1] BITV is a German regulation on Barrier-free Information Technology; in German: "Barrierefreie-Informationstechnik-Verordnung" (https://www.gesetze-im-internet.de/bitv_2_0/BJNR184300011.html)

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standards for the accessibility software in public authorities (Algermissen et al. 2005). Especially the fact that accessible software is the result of a complex process leads to various challenges. When considering the related ISO standards[2] on Human Centered Design (HCD)[3], it becomes clear that usability is the result of a process. Combining this insight with the implications from BITV, accessibility is nothing more than usability for groups with specific needs. Thus, the HCD moves in a field of tension between specific needs (accessibility) and general needs (usability). As a consequence, design teams are faced with the challenge of balancing these needs on a day-to-day basis.

However, accessibility is only one example of such specific requirements. From the perspective of HCD, there are a large number of groups that are not given the necessary consideration by the existing processes and whose requirements are thus left out. This is not only due to a lack of sensitivity to such discrimination, but also to the fundamental systematics of the HCD process, which consists of an iterative interplay between downscaling and upscaling (e.g. Henze et al. 2011, Henze 2012). This downscaling can also affect (depending on the context of use), for example, women, BIPoC, left-handed people, blind people, short-sighted people, people who wear glasses, tall people, short people – and many others (Coleman & Lebbon 1999, Newell & Gregor 2000). We want to emphasize that discrimination in the context of HCD is not limited to the "traditional" categories of discrimination, but is even more multifaceted in individual contexts of use. Thus, the principle of multiple discrimination described by the term intersectionality (Crenshaw 1989, McCall 2005) can also applied to HCD (Schlesinger et al. 2017, Windsong 2018, Rankin & Thomas 2019).

However, the HCD according to ISO 9241-210 is also only one example of a human-centered design process characterized by upscaling and downscaling. Ultimately, other processes, such as design thinking and the *Double Diamond* are also characterized by a constant alternation between convergent (downscaling) and divergent (upscaling) methods (British Design Council 2005, Johansson-Sköldberg et al. 2013, Dorst 2015, Carlgren 2016, Park & McKilligan 2018). Therefore, this paper focuses on the basic systematics and the underlying problem: How can a (human-centered) design process focus while keeping users with specific needs in mind?

For this purpose, we will first deal with the rather static downscaling and upscaling during the life cycle of artifacts before we will then take a closer look at the interplay in the context of design processes.

"DESIGN FOR ALL"

Analyzing the target group is, according to our observation, still the most neglected aspect in industrial practice. When interdisciplinary teams are asked to create a particular artifact (e.g., an online store, an app or a gesture-based interface) as part of hands-on activities, they too often start with directly designing the artifact. Experienced teams differ from inexperienced teams not only in the solutions they design, but more importantly in the questions they (don't) ask.

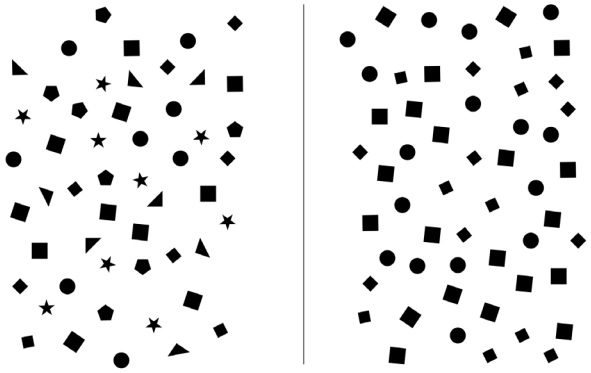

Figure 1: User research changes the target group: (a) Target group without user research vs. (b) with user research

The questions asked by the more experienced and reflective teams first gather information about the context of use (e.g.: Who are the users? What are their tasks? What are their tools? How does their environment look like? Or: In short, what exactly is the problem? Why do you need an online store at all?). One could counter that there are indeed processes in design that try to terminate exactly these questions – for example, the often-cited design thinking (Thoring & Müller 2011, Plattner 2013, McKilligan et al. 2017, Brown & Katz 2019). But even such processes, which even pose the question of the problem at an early stage

[2] Especially ISO 9241-210 (Thomas et al. 2017, DIN EN ISO 2010).

[3] It should be briefly pointed out that the concept of human-centered design is quite critically discussed: On the one hand, "human" is a term that sounds empathetic and empowering in principle, but is completely undefined for the specific context and requires a more precise process to ensure that all needs are covered as much as possible - this is, after all, discussed in this paper. Likewise, in theory, yes, the term provokes the question of design that includes non-human interests. Above all, however, the practice of HCD is repeatedly the focus of criticism, since in reality human-centered means rather profit-centered and people are regarded more as consuming beings.

and involve the user, are problematic if the scaling process described later is not carried out correctly.

Teams who skip these considerations, design with the implicit hypothesis in mind that the online store is "for everyone". In Figure 1, these two user groups are compared: When comparing the left side (without user research) with the right side (with user research) of Figure 1, one thing stands out: Some groups are missing on the right side. In this (and the following) figures, each geometric shape stands for individual users with certain characteristics. This insight helps to initiate a critical reflection of the hypothesis "the design is for everyone" by addressing, for example, the following questions:

- Is the store also for minors?
- Is the store also for welfare recipients?
- Is the store also for pensioners?
- Is the store also for illiterate people?
- Is the store also for people without a car?
- Is the store also for people in the countryside?

DOWNSCALING (ON TARGET)

These questions make a valuable contribution to the next step: The right focus. Only with the right focus design can solve problems and reach the target group – as shown in Figure 2. Focusing increases the total amount of users: When designing for an unspecified target group (left side), then only a low percentage of people will be addressed. If the target group is clearly defined (right side), the pie gets smaller, but the piece gets bigger (even in absolute terms); we refer to this strategy as *downscaling on target*.

In consequence, a differentiated examination of the target group leads to a comprehensive understanding of the context of use. Different methods of user research, for example interviews, focus groups and surveys help to develop a better understanding of the target group (Väänänen-Vainio-Mattila et al. 2008, Rohrer 2014, Robinson et al. 2018). The results are typically made usable within the design team through personas (Chang et al. 2008, Miaskiewicz & Kozar 2011, Schulz & Fuglerud 2012).

In the context of this paper, which is dedicated to the downscaling and upscaling that takes place in design processes, this approach has some weaknesses: The more realistic and closer to reality these personas are designed, the higher the risk that this representation of reality will be mistaken for reality in the further course (Junior & Filgueiras 2005). This leads to various challenges: As personas depict prototypical users, personas (despite their foundation in research) focus primarily on the greatest common denominator. This strong exaggeration of the commonalities leads to the danger that stereotypes develop, a pigeonhole thinking evolves, uniformity dominates in the further design process and individual facets are lost. Numerous existing artifacts from other contexts demonstrate this problem: Car interiors adapted to an average man's body (while increasing the risk of injury and death for those who deviate greatly from that body-especially for women, whose specific characteristics are not taken into account) can serve as one of countless examples (Criado-Perez 2020).

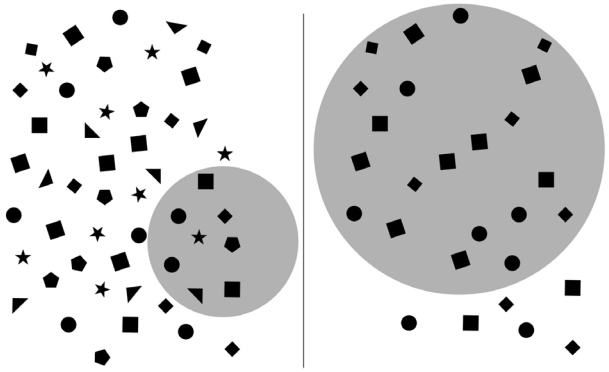

Figure 2: Focusing increases the total amount of users: (a) *Design for All* vs. (b) Downscaling on target

The tension between facets that are relevant for abstraction and those that are irrelevant is not resolved by the persona approach; therefore, we will present a possible resolution of this tension in the chapter on differentiated downscaling.

UPSCALING (OFF AND ON TARGET)

Downscaling is – as just described – the decisive process in order to be able to carry out the process of design in a focused manner. The opposite principle, upscaling, on the other hand, is not relevant until much later: For example, the four phases of ISO 9241-210 are iterated multiple times; this means that several iterations are necessary until a solution is available that can be used effectively, efficiently and satisfactorily in the specified context of use (i.e., in particular by a concrete user group) in practice. Only at this point – when the problem is sufficiently solved for a specific group – strategies for upscaling are relevant.

In practice, upscaling often starts earlier (for example, due to economic constraints); this is fundamentally extremely detrimental to the process going forward: design teams lose the necessary focus and, in the worst case, find themselves again faced with the challenge of having to design "for everyone." Furthermore, broadening the target group on the basis of a usable solution succeeds more easily - design processes can then concentrate on the additional requirements to be considered, and thus remain focused despite the upscaling. This upscaling can basically be done in two ways – as shown in Figure 3.

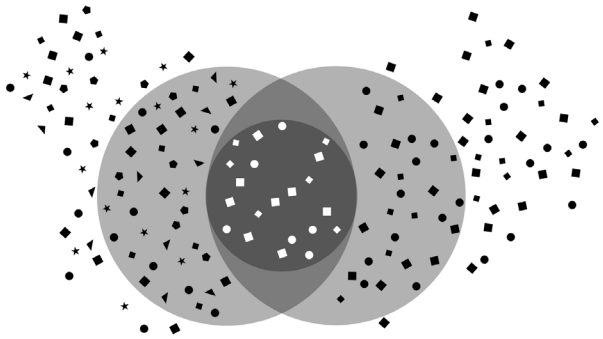

Figure 3: Different strategies for upscaling: (a) Off-target and (b) on-target

On the left side better coverage of the target group (upscaling on target) makes use of established methods. The second approach on the right side (upscaling off target) is broadening the target group: The context of use expands to include users with new needs not previously considered. Design provides the adequate methods to methodically support this broadening and to further develop the artifact accordingly. In the context of design, (bottom-up) approaches to broadening can emerge, but this broadening can also come from outside; broadening can also come (top-down) from changing the business model.

These downscaling and upscaling processes are characterized by their rather static nature: The processes comparatively rarely take place in the lifecycle of an artifact. Permanent downscaling is typically required once at the beginning of the design process, and upscaling also occurs with rather low frequency (sometimes not at all). However, the design process itself also makes intensive use of the mechanisms of *upscaling* and *downscaling*. Thus, in the next chapters we will focus on the mechanisms within the design process itself.

DOWNSCALING IN THE CONTEXT OF HCD

When downscaling in design aims to represent reality as accurately as possible, distortions arise. It is well known from research that ultimately there are always two categories of hurdles: On the one hand, there are errors that affect a large proportion of users - and on the other hand, there are errors that affect only a comparatively small group of users (or even only one user) (Kujala et al. 2001, Lindgaard et al. 2006, Wang et al. 2020). Against the background of limited resources, design will thus always inevitably focus on the first category.

Measures of optimization thus always refer to the achievement of the greatest possible effects for the largest possible group of users - the larger the group of people affected and the more serious the hurdle, the greater the attention paid to this hurdle in the course of the design process. This approach ensures both the best possible use of resources and the best possible overall effect. Ultimately, this is nothing more than an application of the pareto principle (Dunford et al. 2014), (Kiremire, 2011): With appropriate prioritization and focus, 20% of the budget required to eliminate all hurdles can already eliminate 80% of the hurdles – always in relation to the totality of all users.

So far, we have used the term *Design for All* in a shortened form as a synonym for “design for an insufficiently analyzed target group”. This contextualization may initially give the term a negative connotation, but this is relativized by the clarifications we have just made: Methodically correct Design for All goes into the breadth, and does not follow the Pareto principle. Design for All is not design for an unspecified general public, Design for All is the consideration of all requirements within the clearly specified target group. The inadequacy of the Pareto principle in the course of Design for All is thus not in contradiction to intimate downscaling, it is rather a strong argument for its necessity: The construct “all requirements of the target group” is only specific, measurable, accepted, realistic and scheduled if the target group has been sufficiently specified in advance in the course of downscaling.

The idea that design should work for everyone is, of course, ingrained in design discourse. Universal design in particular (Mace 1985; Center for Universal Design 1997) has attempted to formulate rules that attempt to create the basis of a design that works for all possible users. These focuses, among other things, on physical and cognitive limitations – but do not elaborate further, and especially not in detail, on how consideration of such factors should be reflected in the design process. The idea that marginalized persons should also be taken into account is thus formulated – whereas the concrete implementation recommendation is missing. For a design that tries to exclude any form of group-focused enmity and – see intersectionality – the combination of several characteristics, the approach is also not suitable because the focus is on inclusion and not on avoiding discrimination.

UNDIFFERENTIATED DOWNSCALING

Design neglects a multitude of requirements when it makes complex target groups manageable with the help of downscaling. When Nielsen in 2000 postulated that “Five users are enough”, his statement was critically and intensively discussed within the HCD community (see Faulkner 2003, Woolrych & Cockton 2001, Spool & Schroeder 2001). Even if seven, ten, fifteen or twenty users have to be tested in practice, downscaling is still crucial in order to make design processes manageable: The prototypical users (personas) serve as a template for the selection of suitable subjects. Just like the design process itself, the selection that takes place in the course of downscaling also focuses on “the 80 percent”. Only those hurdles that occur in at least two of the usability

tests have a realistic chance of being eliminated in the further course.

We refer to this process of downscaling in the further course of this publication as *undifferentiated downscaling*, since the consideration of specific needs is neither intended nor desired. Figure 4 illustrates how specific needs play no role in the selection of subjects. To this end, we have extended our visual representation and additionally use unfilled geometric shapes. These shapes represent users within the respective user group with individual barriers. During undifferentiated downscaling, these individual barriers are ignored.

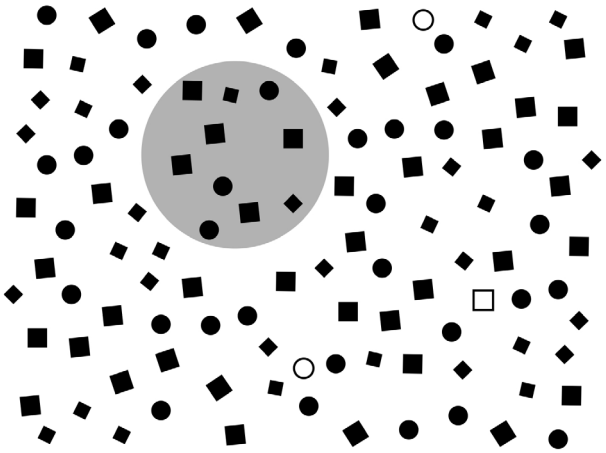

Figure 4: Individual barriers are ignored during undifferentiated downscaling

This observation has a central and obvious limitation: People in real life are not as uniform as the persona identified in the design process. The persona is an abstraction; therefore, against the background of the previous findings, the question inevitably arises whether the right aspects are now part of this abstraction – and whether the aspects not taken into account have been neglected for the right reasons. If one has doubts about the basic validity of the persona approach, there is an alternative interpretation: When the shapes are the known aspects of the target group and the fillings are the unknown aspects, the bottom line remains the same - the unknown aspects are not considered during downscaling.

Depending on the specific requirements considered in each case, the percentages vary greatly. For some of the groups considered at the beginning (e.g., women), the percentage is significantly higher than shown, while for other groups (e.g., blind people) it is lower. Figure 4 therefore initially only makes clear that specific needs occur with different frequency depending on the context of use considered and are initially left out of the downscaling required for the design process.

This practiced process of downscaling is the enemy of any specific requirements. But in practice, this effect can even be exacerbated: If in the further course after downscaling (of the sample) a generalization of the findings (upscaling) takes place, this process acts like a target group filter, as shown in Figure 5: When using the dark gray circular area (the result from the downscaling, see Figure 4) for the upscaling attempts (all light gray circular areas), individual barriers do not reappear during the process of upscaling. Under this focal lens, only the requirements lying in the overlap point remain – and the originally finely differentiated target group becomes narrower. In theory, user research does not change the target group - but in practice, strategic and operational decisions are often based on these findings. Implicitly, at many points in the process, the “stamped reality” from Figure 5 might be used instead of the “real reality” from Figure 4.

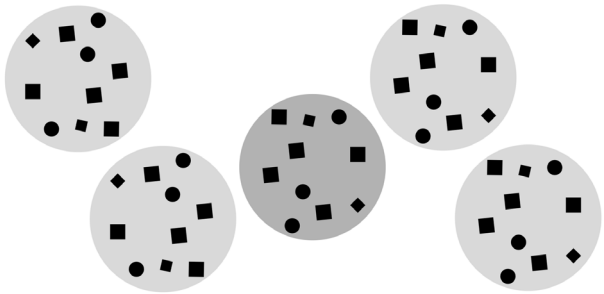

Figure 5: Subsequent downscaling and upscaling distorts the reality

In particular, qualitative findings from the research shape the further orientation of designers and developers in a decisive way. The effect shown in Figure 5 is not a defect in the system, but ultimately a desired effect of design: the focus should shift from the world of thought of the designers to the world of thought of the users. Therefore, regarding the undifferentiated downscaling we must conclude: It is methodically correct and leads to a representative user study. At the same time, however, it is also the reason why we experience a multitude of systems in practice that do not work for users with individual barriers.

DIFFERENTIATED DOWNSCALING

As explained in detail in the previous chapter, downscaling is not a priori non-discriminatory. On the contrary: Downscaling currently practiced in the context of design processes (which is also mandatory in the course of manageability) is always discriminatory. By focusing on the highest common denominator, design processes ignore the specific needs – especially of smaller marginalized groups. For the sake of clarity and precision: In our further considerations, a small marginal group is a group with individual requirements that affect less than five percent of the total. Thus, on the one hand, these requirements are well below the threshold of 20 percent (of the Pareto principle) and, on the other hand, it is unlikely that subjects from this

group are already accidentally recruited during undifferentiated downscaling.

Thus, obvious candidates for such groups are motor and cognitive impairments of any kind. However, some of the aspects mentioned at the beginning (e.g. left-handed people, BIPoC, women) would generally not be covered. However, since the relevant basis is the context of use, the specific requirements of women, for example, can also be covered by the five-percent hurdle; think, for example, of specialist applications for occupational groups still dominated by men. Men, however, can as well be affected by the five-percent rule, for example when specialized applications for educators are designed[4]. From these findings, a better downscaling strategy can be derived; we refer to this as *differentiated downscaling* because of the great importance of a differentiated approach.

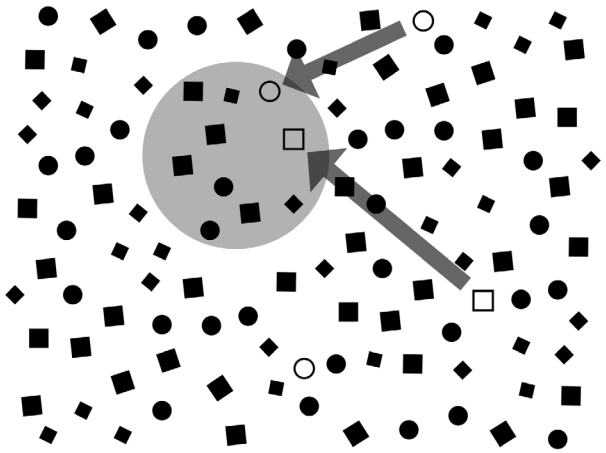

Figure 6: Downscaling with a stronger focus on marginalized groups

As shown in Figure 6, marginalized groups with specific needs must be overrepresented in the design process in order to be adequately addressed: The filled square (general needs) is replaced by an unfilled one (specific needs). The same is done for the specific needs represented by the unfilled circle (note, however, that only one circle is replaced). All of these specific needs that are overrepresented in differentiated downscaling, would fall by the wayside in undifferentiated downscaling. Or to put it another way: If specific needs are quantitatively so serious that they are already taken into account in undifferentiated downscaling, they do not have to be overrepresented in differentiated downscaling. All other specific needs, however, only gain access to the sample through their intentional overrepresentation.

Two different cases can be observed among these specific needs: On the one hand, quantitative minorities (e.g., cognitive and physical barriers) are permanent beneficiaries of differential downscaling. On the other hand, temporary minorities (e.g., BIPoC and women) also benefit from differential downscaling. This also results in two slightly different effects: In the first case, differentiated downscaling serves a better representation of reality with all its facets – since successful design is decided precisely by these facets. In the second case, differentiated downscaling serves to reduce discrimination and inequalities that lead to current underrepresentation. In this way, differentiated downscaling also makes a substantial contribution to breaking through the chicken-egg problem: As long as groups are underrepresented, they are given special consideration by the five-percent rule.

The five-percent rule makes itself partially superfluous through its consistent application. Therefore, the differential analysis of the downscaling process is not a one-time activity; rather, the design process must regularly validate the validity of the five-percent rule – and, if necessary, include new groups. In practice, this has very concrete implications, for example: A government agency has 1,000 employees, one of whom is blind. If a new application for booking business trips is to be introduced, then he must be included in the design process. Or if this authority introduces a tool for internal project management for its 50 managers (48 male, 2 female), then the differentiated downscaling ensures that at least one female manager is included in the design process. Or if there are three BIPoC working in a logistics center with 500 employees, then at least one should be included in the design process here as well.

UPSCALING IN THE CONTEXT OF HCD

As we have just explained, there are a number of pitfalls in downscaling. But upscaling can equally lead to a distortion of reality. The right strategy is also crucial here to avoid falling off the horse on the other side: Differentiated downscaling should not lead to a situation where consensual requirements (“the 80 percent”) are no longer appropriately prioritized and focused.

[4] In Germany, the proportion of male kindergarten teachers exceeded the five percent hurdle (5.2 percent) for the first time in 2015 (2014: 4.8 percent) (see https://de.statista.com/infografik/14678/maennliche-paedagogische-fachkraefte-in-kitas/).

This fear is not taken out of the air, but several aspects lead to the fact that the basic problem with upscaling in design processes is less serious: First, even after the consideration of the marginalized groups, subjects without specific requirements still remain in the target group – and are the focus of the design process. Their consolidated requirements are therefore still taken into account (on the basis of the Pareto principle). Second, the marginalized groups do not only contribute specific requirements, so these subjects also play a crucial role during further consolidation. And third, general and specific requirements are often mutually dependent. For example, BITV requires accessibility and usability.

UNBALANCED UPSCALING

The broad masses thus benefit from the requirements of special groups. From the practice of accessibility assessment, for example: Accessibility analysis and improvement makes interfaces better for everyone. This philosophy is for instance proposed by the design and consulting company IDEO; they recommend to pay special attention to the extremes in design processes[5]. In concrete terms, this means that the sample created by differentiated downscaling is unbalanced – it disproportionately represents the marginalized groups. If this distribution is adopted in the course of upscaling, then the marginalized groups are also disproportionately represented in the target group focused on in the further process. We refer to this effect as *unbalanced upscaling* and illustrate it in Figure 7 (left): The resulting specific needs are overrepresented during this kind of upscaling process.

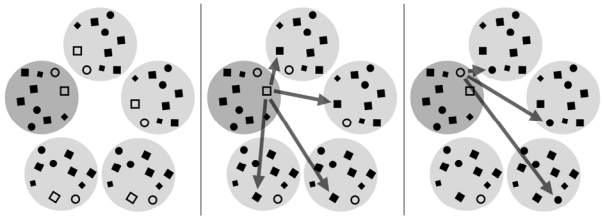

Figure 7: Different strategies for upscaling: (a) Unbalanced upscaling vs. (b) Balanced upscaling vs. (c) Balanced upscaling with inverted downscaling

The danger of unbalanced upscaling is that different intentions are mixed together – and contradictions can arise in the further design process. The objective of downscaling and classical design processes is the most effective and efficient use of resources (achieving as much as possible for as many as possible). The objective of differentiated downscaling was the best possible addressing of individual barriers. If these two aspects are now placed next to each other in the context of unbalanced upscaling, they inevitably compete with each other. This means that both directions of objectives thus also become the subject of prioritization and focusing. It sounds paradoxical at first: Although the marginalized groups are given additional weight by unbalanced upscaling, this weight is usually not sufficient to achieve a sufficiently high priority for these concerns.

BALANCED UPSCALING

The greatest weakness of unbalanced upscaling thus does not lie in the overrepresentation of the concerns of the special target groups – on the contrary, the weakness arises from the systematics of the process of prioritization and focusing. This systematics is necessary due to the limitation of resources. As our proposed strategy should be capable of maintaining the two different intentions of the design process, these specific needs may not get lost during upscaling. This requires first of all a removal of overrepresentations in the course of upscaling. With the maxim “as much as possible for as many as possible” the specific needs have to be put in relation to the population; this leads us to balanced upscaling, as shown in Figure 7: By replacing individual needs by general needs (Figure 7, middle) and additionally taking into account the insights from differentiated downscaling (Figure 7, right), upscaling is capable of inverting the downscaling process.

This strategy results in two advantages: When prioritizing hurdles, existing systematics can be retained. Based on the recognition that the broad masses benefit from the needs of special groups, general improvements can be achieved with the resources originally available for design processes; in practice designers regularly observe the following effect: What is unusable for special needs groups is often usable by the general public only with great difficulty (Astbrink et al. 2003, Keates & Clarkson 2003, Borys et al. 2013). When design processes increase effectiveness for special groups, they increase efficiency and satisfaction for the general public at the same time. Secondly, balanced upscaling makes use of the separation of concerns: Balanced upscaling explicitly rejects the hypothesis of resource neutrality. If available resources are to be distributed between two diametrically opposed intentions, then two good intentions enter into competition and conflicts are pre-programmed. Instead of moderating these conflicts in the context of design

[5] see: https://designthinking.ideo.com/resources/extremes-and-mainstreams-design-toolkit-by-ideo-org

processes on the concrete case such conflicts have to be resolved in advance. Additional resources must therefore be allocated to the additional activities up front. While the interleaving in downscaling leads to the resource-saving integration of the additional activities, these different interests have to be balanced in upscaling.

In consequence, balanced upscaling follows the previous process of prioritizing and focusing the requirements on the basis of the Pareto principle with the resources available for design. Since it is based on the differentiated downscaling, specific requirements that are "majority-driven" are also taken into account. At the same time, an additional budget is provided to address the specific needs in the process. During this process synergies are considered, but all specific needs are equally significant. We would like to emphasize that this requirement leads to a fundamentally different systematic for prioritizing needs: Inclusive design decisions are based on the lowest common multiple rather than the highest common denominator. Thus, the second budget does not follow the didactic of efficiency and effectiveness, but rather the principle of equal opportunity.

These marginal adaptations of the previous processes are fundamental; and marginal adaptations lead to central effects. This is clearly illustrated by the (already discussed) example of *accessibility vs. usability*: First, part of the budget for usability no longer has to be diverted for better accessibility; instead, the budgets are planned separately and backed up with concrete goals and metrics. Second, usability measures no longer have to be covered by the accessibility budget; instead, the budget can also be used for specific requirements that are eligible for majority support. Third, individual barriers do not compete with general requirements; the principle of equal opportunity is separated from increasing effectiveness and efficiency.

DISCUSSION

In the end, what can this publication achieve in this field of tension? Many of the topics have already been analyzed and discussed in the field of UUX from different angles and under consideration of different facets. However, the systematics of downscaling and upscaling presented and explained in this paper and its application to design processes has not been done in this form before. Thus, the paper makes a valuable contribution to resolving the tension between general needs and individual barriers. This can be achieved on the one hand by separating downscaling from upscaling and on the other hand by using different approaches for integrating specific needs.

This publication is intended to help practitioners in the field of UUX, for example, to differentiate between usability and accessibility on the one hand and to exploit synergies on the other. At the same time, these findings and methodologies can be transferred to other design disciplines and be used for supporting specific goals and concrete strategies (advancement of women, accessibility, etc.).

Of course, self-critical reflection also includes the fact that the mandatory prerequisite postulated in the context of balanced upscaling (additional budget) is not part of the solution but part of the problem in many practical issues. We are aware of this problem, although this publication at least provides a substantive argumentation basis for claiming additional budgets. Nevertheless, the design teams should never be forced to make difficult trade-offs that cannot be handled with design, regardless of the concrete framework conditions – even if resources are strictly limited. If economic reasons really do make trade-offs unavoidable, then they must be made at the management level. A competition between the two goals can only be resolved – even with limited overall resources – through separate budgets; even if, in the worst case, this means that something has to be diverted from the existing budget.

A second hurdle may arise in practice from the presence of a large number of marginalized groups with specific needs. In the extreme case, the sample is filled exclusively with representatives of marginalized groups – and is not even quantitatively sufficient for all marginalized groups to be represented. While the aforementioned intersectionality can sometimes lead to additional challenges, it is a valuable phenomenon here that can significantly reduce the effects: For example, female BIPoC provide a particularly large number of specific needs in design processes, or large left-handed people help identify edge cases in a particularly targeted way. If this strategy also does not lead to a resolution of the conflicting goals, the overall sample can alternatively be enlarged in differentiated downscaling instead of replacing individual subjects. This enlargement is not the ideal solution, since it increases the effort for the design process, but it is a compromise that can be achieved (especially if this concept is not used in an excessive form) – a compromise that can help prevent discrimination, sexism, and racism in and through design solutions.

CONCLUSION

On the one hand, the strategy we propose allows HCD processes to focus and narrow down the issues (in the course of differentiated downscaling), while remaining open to prioritized generalization of findings (in the course of balanced upscaling). Downscaling itself – despite its discriminatory effects – is not negative; downscaling is necessary to maintain focus in the design process. Downscaling makes complex realities manageable; personas (properly done) are as important

in practice as maps – they simplify a complex, multidimensional and differentiated world. This simplification is a necessary condition for orientation and practical usability of these tools. However, our persona map ultimately only draws our attention to the aspects and facets that are particularly relevant.

With the systematic linking of downscaling and upscaling, this paper helps us to fulfil this purpose – to maintain the structuring and focus-supporting guard rails in the further course of design processes. Instead of an arbitrary section on reality, the differentiated downscaling directs the view to the special "sights". At the same time, reflection on the processes of downscaling will also help to ensure that this issue receives greater attention in future discourses on design methods.

Legal foundations support the process of finding bottom-up synergies in the area of tension (general requirements vs. individual requirements). Although template-like and standardized requirements have a particularly strong resonance in practice due to their ease of application, they are not entirely harmless: They can be mistaken as a top-down approach. Thus, on the basis of our considerations of downscaling and upscaling, these regulations should even more clearly point out that no useful shortcuts or top-down solutions make a differentiated examination of the context of use dispensable. In order to effectively avoid playing off groups that are discriminated against in different ways, bottom-up strategies such as differentiated downscaling in combination with balanced upscaling have to be implemented.

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