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Dr. Karolina Zielinska-Dabkowska/PL/CH and Barbara Bochnak/UK
Creating a more conscious built environment for day and night-time settings
through interdisciplinary collaboration.

The last decades have seen an increase in the speed, scale and scope of urbanisation, fundamentally shifting the character of the built environment and engendering a radical search for new and resilient design practices. Although we, as society, live in the age of technology, inventions and almost unlimited access to information, we rarely use these opportunities to our advantage to improve the quality of life. It seems that multidisciplinary research can provide an opportunity to bridge that gap and, as such, should assume a central role in the future, forming the basis for dialogue between research and design practice in order to create sustainable, healthy, more purposefully built environments. Ultimate success requires both understanding the complexity of the relationships between emerging research findings and the opportunity to apply them in a multifaceted, multidisciplinary way.

Although researchers and practitioners have approached this matter from diverse perspectives, until now this vital subject had not been addressed in a holistic way. Predominantly due to the limited exchange of ideas and discourse between these fields, this subject could not be fully promoted and applied in practice. This paper aims to establish and define the fundamental aspects that are necessary to create a backbone for such successful interdisciplinary collaboration and to promote essential future change in the design approach for the built environment [Fig. 1].

Team players

For the purpose of this research, a distinction has been made between the three main groups focusing on this

subject. The first group of experts are well established through their exploration of the issues of planning and designing sustainable built environments during the day-time. Their attention is focussed on the appearance of buildings or cities by day, overlooking the majority of night-time aspects. This is often due to a lack of understanding of the potential consequences and impacts, and suggests a need for broader knowledge of the subject. Correspondingly, consideration of health and well-being in the human-made environment is not appropriately reflected in planning policies, strategies or design, and seems to be disjointedly classified as 'nice to have' rather than essential.

The second group's focus is on artificial light in built environments and they are concerned with specific approaches to practical design after dark. Nevertheless, the current design attitude has barely addressed global strategies, environmental or health issues. Their voice is still not strong enough, possibly because their field of activity and profession are relatively new and still developing. In some ways, they manifest a persistent belief that design research has little impact on practice and often has little or no role in the design process [1].

The third group of professionals concentrate on research and new discoveries related to humans and their environment, including new technologies and construction materials, with a clear focus on innovation and new and ground-breaking trends. Their work enables a better understanding of the complex aspects of different fields related to: vision, cognition, behaviour and sociological, psychological and physical health in relation to humans and human-made settings. However, the question of how this research can be implemented in design practice remains, as this group communicates, operates and shares knowledge in its own particular way [2].

The future

The democratisation of ideas

In the design industry there is a growing need to establish a horizontal, democratic hierarchy, with no place for design that is purely ego driven. There already seems to be a gradual shift away from signature style to the setting up of a collective, multi-author design process, which includes acknowledging teamwork and the combined effort of different parties involved in the built environment. Due to the technological complexity and sheer scale of architectural designs, it is no longer possible for architects and planners on their own to acquire all the necessary knowledge to conceive their ideas. As such, without the help, creativity and solid technical input of other engineers and multidisciplinary consultants the projects would remain unrealised. Rem Koolhaas, founder of OMA, in one of his recent talks argued that "a strong architectural design is not about architects" – what we

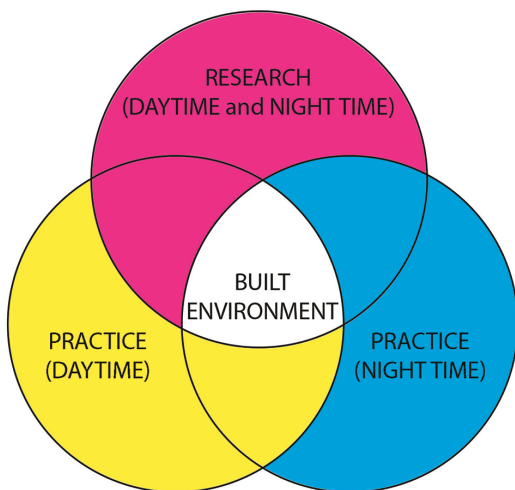


Fig. 1: Setting up a collaborative, democratic working relationship in the interest of the built environment.

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see as the iconic design of a superstar designer is, in fact, the product of collective and multidisciplinary knowledge exchanged, orchestrated and conducted by a lead designer. The old notion of singularity of creation no longer has a place in the complex and elaborate future of the built environment. "[...] Because of the reading of architecture as icons, there's a really unfortunate way that contributions of other partnerships and other forms of knowledge are ignored [...]"[3].

Quality of life (QOL) by design

QOL describes the general well-being of individuals and societies, outlining negative and positive features of life. It observes life satisfaction, including everything from physical health, family, education, employment, wealth, religious beliefs, finance and environment, both human-made and natural. Well-being, health and wellness are often overlooked in the design process despite the fact that places are designed for humans, i.e. living organisms. When these factors are taken into account, the design outcome dramatically changes the way places are designed and inhabited. A great propagator of this notion is Sir Richard Rogers: "My passion and great enjoyment for architecture, and the reason the older I get the more I enjoy it, is because I believe we – architects – can effect the quality of life of the people"[4]. The environments created today are simply unhealthy and unsocial. However, when involving a holistic approach, human centric design becomes not an "add-on" but rather a fully integrated philo-sophy of fundamentals. Prominent examples of this approach are recent proposals for third age living [5] which create not only well-designed spaces that take into account the physical needs of their inhabitants, but also fully embrace sociological, emotional, and psychological needs. The unique approach of the design team defined the benefits of including multi-generational living facilities and encouraged interaction by creating a natural need for different groups to interact and to see demographic change as an opportunity and not as a crisis.

Under one roof

With the rising complexity, budgets, and scale of the latest architectural projects, clients increasingly prefer to deal with one company, i.e. a multidisciplinary consultancy that can provide all the required services under one roof. This way of appointing the design team is perceived as creating a better flow of communication between the different disciplines, faster solutions to problems, and time and money savings due to established company processes and ways of working. Moreover, responsibility is focused on one entity. On the other hand, this approach might prevent the introduction of innovative solutions to the project. In order to avoid risk there may be a tendency to avoid employing smaller or less known new outlets. However, if only tested and proved processes and solutions are applied, there is very limited possibility for error-inducing creativity.

The Internet of Things and human life in the Age of Superintelligence

In recent decades we have started to create technologies with future consequences that we did not quite grasp. We still have a very limited understanding of the long-term effect of these technologies on the environment or human well-being due to bad inventions or the desire for pure economic gain. In the past, designers used intuition to overcome challenges. Nowadays designers, as well as the end users, are overexcited about new technologies like the Internet of Things (IoT) and the endless possibilities of control and application they offer for use during the daytime and night-time. IoT is the interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data via Ethernet or Wi-Fi. Today it helps to create smart buildings and to control thermostats and sprinkler systems, lighting, appliances, electrical outlets, heating, and cooling systems. From a home security perspective, this also includes alarm systems and all of the doors, windows, locks, smoke detectors, surveillance cameras and any other sensors that are linked to it. At night, in the outdoor environment, it is used more and more to control street lighting. All this is extremely helpful in streamlining processes and connecting all the data while working in perfect harmony. However, concerns are increasingly raised regarding the possibility of cyber-attacks and security breaches with such connected systems. It is clearly necessary to establish processes to prevent any potential threat from either artificial intelligence (AI) or, as we like to refer to it, superintelligence itself and less dangerous, but still menacing, hackers. We understand quite well the mechanism and potential of security bridges on a human level but we can still only speculate about the consequences of our own invention, AI, turning against us creators and using all the data we willingly provided to manipulate us into obedience.

Diversity and inclusion

The design industry requires change, especially at the mid-level and senior level, which is still predominantly 'white and male'. Our society is extremely diverse; this is especially apparent in big agglomerations attracting people from many different backgrounds and cultures. As designers responsible for creating our environment, we should strive to include many different perspectives and needs. In theory, we are all clear that diversity creates diverse and inclusive solutions. However, in practice we still struggle to ensure that we are representing different standpoints in a balanced way. It will take more than one generation's efforts to ensure that we all have equal potential to express our innate talents, but maybe the starting point would be for designers to become more vocal about our creative processes. Even with new initiatives like "Return- to -Work" schemes, which help people who have taken a career break of two or more years get back into work, whether due to childcare, responsibilities towards parents or for health reasons [6], we still suffer from rather uniform and non-diverse design

professions. As such, in the absence of natural diversity in our sector we might, if we allow it, include minorities' perspectives by opening a dialogue with all our stakeholders. After all, when we talk about the built environment we are all clients, as what is designed shapes both us and our lives.

Show and tell

In recent studies, researchers started using popular apps like Instagram and Twitter in an attempt to analyse preferences and patterns apparent for built environments. It is evident that in the age of communication we are all architectural and design trendsetters. And now, with the use of IoT, the design team might quickly establish new developing preferences and see trends and needs for the emergent typology of the designed project. How we present and communicate our designs and ideas has changed dramatically in recent years. With the use of social media platforms, information is out there in seconds. It is one means of communicating to the outside world the design ideas as self-marketing, and to swiftly receive valuable feedback. Everybody can now be a critic or advocate of design. We can all influence what the next generation of buildings will look like. If we want to be involved, then it really is up to all of us. After all, our entire physical world becomes digitally real before it is even built.

The city as a playground

If one imagines the perfect city, it would most likely be a space where everyone feels at home and part of something great and fun. Would it be possible for all of us to be part of the process of creating our ideal city? Recent experiments using gaming simulations allowed the general public to be more involved in the public consultation part of the building process. Interestingly enough, within that process, by encouraging the feedback loop to be closed, everyone to be heard and included, the likelihood of the general public accepting the new proposals was much higher than with the traditional non-inclusive process. Further experiments gave children the opportunity to design cities through gaming workshops. These as well were very successful and inspiring for designers, enabling the free flow of creativity, exchange of ideas, and challenging questions. Community-led built environments with inhabitants participating in the design process seem to be the answer.

Design as a common good

With the human populations growing, with a predicted 75 per cent of people living in urban areas by 2050, [7] the cost of building land in cities has become increasingly expensive and profit-driven developers seem to be forgetting that cities are for people. Therefore, socially responsible design should be the motto of the architect and planners. World-renowned architect Dame Zaha Hadid seemed to understand the notion of the built environment and the right to public space quite well when she stated: "Architecture is really about well-being. I think that people want to feel good in a space... On the

one hand it is about shelter, but it is also about pleasure. The intention is to really carve out of a city civic spaces, and the more it is accessible to a much larger mass in public then it is about people enjoying that space. That makes life that much better. If you think about housing, education, whether schools and hospitals, these are all very interesting projects because in the way you interpret this special experience" [8]. Another aspect is that humans have a natural need to feel connected while at the same time want their space to allow privacy. In the built environment that might manifest in the way we create our cities. With the lack of sufficient space within the city centre, one might compromise what is perceived as a need for luxury of space to ensure that the necessary quantity of habitants can be included within the same area. This leads to rather limited public space with almost no versatility within that zone and including only those pedestrian passages and pavements that are deemed absolutely necessary. Multidisciplinary investigations show that people need shelter, but also for well-being and health they need an area in which they can relax and enjoy the abundance of nature. With the rise in the number of people living in urbanised areas, researchers are warning that our newly developed habits and our desire for brightness and illumination 24/7 might lead to serious health issues [9]. In this sense, darkness and space become the new luxuries.

The ten commandments of interdisciplinary collaboration

I. Speak the lingo

Forming successful cross-disciplinary liaisons requires total openness to the language of each collaborator's discipline, since each discipline uses a diverse and ever evolving jargon. Being willing to learn other fields' terminology in the early stages of collaboration and questioning the meaning of words used can create a unique communication platform. Some simple tools, such as a technical glossary, can be extremely useful. Agreeing a joint nomenclature with all collaborators early in the project might be the only way to ensure success: consistently writing equations and coding, using standardised formats and intelligible style. And, most importantly, one should be mindful to continuously discuss outputs to ensure the understanding and involvement of all collaborators since a good relationship is always based on mutually comprehensible communication.

II. Know your place and process

The building industry is constantly searching for a better formula to simplify and streamline both the design team structure and the design process itself. Because of that, design professionals might seem to be entangled in an identity crisis, trying to remain constantly innovative, agile, creative and, at the same time, cost savvy, efficient, time and delivery driven. Many variations in the design process and team structures for perfect design solutions are described in numerous papers related to design thinking [10] and the design process. There is a tendency to

assure the client that design is purely a process and that creativity can be locked in a repetitive framework. However, looking closely at the design methods of various designers such as Frank Gehry, Zaha Hadid, Philippe Stark or Patricia Urquiola, we can see that there is only one pattern that can be clearly observed – a lack of pattern. No architect's design process is ever the same, no team structure ever works in the same way and yes, the ideas come from non-standardised sources. There is no one way or magic formula for organising a design team and the design process; the approach must be driven by the context of the situation, the project, and the team itself. At the same time, it needs to remain agile and fluid, allowing for complexity and unpredictability. Maybe it is time to admit that the real design process is messy, chaotic, unstructured and is never the same twice. One might even go a step further and acknowledge that creativity plays a role throughout the whole design process and is not limited to any singular stage of the design. Maybe it is time to stop trying to present design and designers as a simplified management process.

III. Bridge the boundaries beyond comparison

'Creativity often requires interdisciplinary knowledge' [11]. By stretching the connectivity between different fields and infusing one into another, designers of the built environment can adapt and challenge the ever-changing social and technical climates of today. Disciplines such as sociology, psychology, neuroscience, lighting design, landscape design, urban design, various branches of engineering, ecology and bio-science, to name but a few, could interact and exchange knowledge, helping each other to advance research and apply findings. When operating in "silos", designers and researchers are more likely to overlook and simplify issues that arise. This can be avoided through peer review, and even better through interdisciplinary collaboration in which the boundaries of individual disciplines are blended and knowledge is shared freely and experimentally, allowing the flow of creative solutions. The complexity of creating the appropriate built environment involves many different disciplines and the role of the lead designer, urban planner or architect most resembles that of a conductor, as defined by the famous Benjamin Zander: 'The conductor's power depends on his ability to make other people powerful' [12]. Similarly, the lead designer's responsibility is to encourage all disciplines to come up with the best possible answer to the spatial and social query by fully participating and leveraging their knowledge. By doing so, multidisciplinary teams might look beyond the ordinary and deliver the multifaceted and responsive environment that present day humans need and expect.

IV. Honour agile collaboration

There is an African proverb which beautifully summarises the potential of teamwork: If you want to go fast, go alone; if you want to go far, go together. A multidisciplinary team embracing people with different skill-sets and

experiences working towards a mutual objective can create truly innovative solutions, defined as the creation of the preferred future. Herbert A. Simon, Nobel Prize laureate, describes it quite well, illustrating clearly the design thinking methodology: "Engineering, medicine, business, architecture, and painting are concerned not with the necessary, but with the contingent – not how things are, but how they might be – in short, with design... Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" [13]. This approach, combined with agile collaboration, where ideas are tested inside out by multidisciplinary designers, enables the quick recognition of potential flaws and focusses on action and solutions and is the easiest and quickest way to achieve desirable results. In this case, agility is understood as a constant feedback loop. Honest feedback from the team, end users, and other stakeholders provides the opportunity to streamline the design and improve solutions. As such, it is critical to create a culture of feedback and encourage team members to find ways to receive feedback. Contrary to common belief, this will not slow the whole process down. Instead, it will make it possible to shape and evolve the concept over time, making it more meaningful, ultimately saving time and allowing people's needs to be matched with available technologies in the best possible way and creating value for both clients and end users, all of which will result in the creation of a better future for us all.

V. Observe nature and see things differently

The most successful designers are the ones who are not afraid to ask questions and search for new solutions, who challenge the obvious and can observe that the world itself has its own way of finding astonishing solutions. Taking inspiration from nature to generate groundbreaking solutions can help practitioners to improve the way they design and construct the built environment, positioning them at the forefront of their respective field [14]. Visionary inventor Steve Jobs described this kind of designer as: "[...] the crazy ones, the misfits, the rebels, the troublemakers, the round pegs in the square holes... the ones who see things differently – they're not fond of rules... You can quote them, disagree with them, glorify or vilify them, but the only thing you can't do is ignore them because they change things... they push the human race forward, and while some may see them as the crazy ones, we see genius, because the ones who are crazy enough to think that they can change the world, are the ones who do" [15].

VI. Say no to a society of mutual admiration

"Having the same people with the same background and the same mind-set doesn't bring scrutiny or challenge – it just perpetuates group thinking, with everyone becoming 'yes' men" [16]. There is a lack of counter arguments today. In a process where all involved vote in favour of one solution without questioning it, the end result might be too predictable, not necessarily taking into consideration all the basic needs of the end users. Creative tension



and exchange is necessary to achieve the extraordinary. A proper balance between synergy, understood as a state in which two or more things work together in a particularly fruitful way that produces an effect greater than the sum of their individual effects, and discord – disagreement between people – is indispensable. To harvest outstanding results, individuals need to bring in diverse thinking, scrutinise designs, and be permitted and even encouraged to challenge one another.

VII. Avoid prescribed design

In the past designers were told that there were certain ways to properly design built environments, that they should religiously follow agreed rules and guidelines, that linear thinking would simplify the design process and that the rigid normative frameworks and methodologies were the only way forward. Nonetheless, the latest research is proving this approach wrong, claiming that it limits the creativity of the designer. According to architect and visionary Rem Koolhaas: "The old-fashioned Western 'this is' 'that is' is no longer tenable"[17]. Today humans know more about themselves and how they respond to the built environment thanks to the expanding body of research that has evolved within the neuroscience community in the last two decades. The profession of architecture has become a partner in developing the application of this knowledge base in order to increase its ability to be of service to society, as many designers and planners fail to create healthy urban environments through a lack of understanding, experience, and training. Courses such as the 'Certificate in Neuroscience for Architecture' are offered to students of the graduate program at the New School of Architecture and Design, San Diego, USA. It gives students a comprehensive background in aspects of neuroscience as they relate to architecture and the built environment [18].

VIII. Mind the technology

The way people design changed dramatically with introduction of Computer Aided Design (CAD). Nowadays the use of algorithmic design (Algoarchitecture) and Building Information Modelling (BIM) allows optimisation and efficiency, while new materials, technologies and pre-fabrication help to advance the building industry so that it can keep up with the pace of development in other key industries. There is hope that soon buildings will be formed with the same speed and precision that computers or cars are assembled. The challenge is keeping up with progress and learning from other industries how to adapt the technologies that are the most appropriate for the built environment. For example, "Generative design involves finding high-level goals and constraints and using the power of computation to explore thousands and thousands of design options"[19]. It needs to be considered in parallel with Additive Design (AD), which can be defined as 3D printing on an industrial scale. First attempts have already been made to print whole structures, including pedestrian bridges and small pavilions. Any discussion about future technologies is not complete

without Virtual Reality (VR). Many design practices have already embraced this still clumsy technology with the aim of presenting still-to-be-built structures to clients in as real-life a way as possible. In coming years we all hope this technology will improve, allowing more seamless workflows. Augmented Reality (AR), similarly to VR, has become more popular in recent years, facilitating the connection between physical environments and digital designs, thus allowing easier representation of the proposed design solution. The last, but by no means least, technology that should be considered as a game changer in industry is cloud service, which allows designers to work freely and work together unconstrained by their physical or geographical location. In interdisciplinary collaboration, this tool is absolutely essential as it provides a common, shared place and ensures that every contributor to the project has simultaneous access to all project information on demand, irrespective of location or time zone.

IX. Have a say

In the past city inhabitants, as the end users of the built environment, were often confronted with a final design delivered by the municipality or developer that did not fulfil any of their needs or desires. Today, things are changing and people are becoming more conscious of the places they use and live in. By being vocal about their requirements, they can influence or even co-create and financially deliver design projects. Social movements such as new "Bottom-Up Urbanism" are changing the face of future city planning. By using different initiatives like crowd-funded urban projects, which allow people to participate actively via an online platform, citizens can influence their local city-planning proposals [20] [21]. A community of similarly minded people becomes a client in its own right. Through careful dialogue, architects and planners can ensure that residents' voices are heard.

X. Remember all bets are off

There is a recent tendency which fully embraces efficiency and economy as the key to the success of a project. Through the pressure to deliver the design in the quickest and the most efficient manner, designers are being pressed by the client and they quite often revert to the most tested and predictable solutions, ensuring the delivery is streamlined, proficient, and their fees are paid. One could say that "[...] building things is terrifying. It's expensive, it takes a long time, and it's very complicated. And the people that build things – developers and governments – are naturally afraid of innovation, and they would rather just use those forms that they know you'll respond to"[22]. Using tested solutions is not wrong in itself, but no progress can be made if there is no allowance for experimentation, free thinking and creativity. Guarantees, implications, or assumptions regarding the outcome no longer apply; therefore, an unpredictable, flexible, non-linear approach is now the way forward.

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