Requirements for Designing Kind Spaces

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***Abstract*—Kindness is an important quality of human behavior, and the physical spaces in which people live, work, and interact can significantly influence the experience and expression of kindness. With the growing integration of digital technology into physical spaces, designers have a unique opportunity to intentionally foster and amplify kindness while also mitigating unkindness. However, creating such spaces is a challenge that requires an understanding of the various intertwined digital, physical, psychological, and social dimensions. To gain such an understanding, it is important to identify and articulate the key requirements that reflect these dimensions and their interplay.**

In this paper we explore the notion of a *kind space*—a space intentionally designed to enable and amplify kind behavior while preventing unkind behavior. We argue that the design of kind spaces requires consideration of two essential requirements: *topology*, the arrangement and relationship of digital and physical spatial entities, and *psycho-social* factors, such as emotionality and social relatedness. We examine these requirements and their operationalization, proposing a way for designers to create kind spaces. We use a professional workspace scenario to demonstrate the application of such requirements. We suggest that the deliberate use of digital technology in creating kind spaces can positively impact individuals and communities.

***Index Terms*—Requirements, Kindness, Kind Computing, Software Engineering**

I. Introduction

There is widespread recognition of the role of physical spaces in shaping humans' lived experience and wellbeing. A well-designed space can positively impact people's emotional and social well-being, while a poorly designed space can have the opposite effect [1]. For example, designing space properties, such as natural lighting, access to green spaces, and comfortable seating arrangements, have been shown to improve people's moods and increase their sense of well-being [2]. Physical space can also influence people's behavior and their social connectedness. People are more likely to engage in prosocial behaviors, such as helping others or sharing resources, in spaces that are designed to promote a sense of community and social belonging [3].

With the increasing integration of digital technology into physical spaces, there is a growing opportunity to leverage these advancements to design spaces that intentionally foster social connections and improve well-being. However, this opportunity also comes with the risk that poorly designed technological interventions could have the opposite effect, worsening social connections and well-being. Thus, it is important to identify and address the challenges of using digital technology to design spaces. We posit that enabling and nurturing *kindness* in such spaces, supported by software technology, may contribute to achieving our goal.

Kindness is a prosocial behavior that can boost happiness and wellbeing of both givers and receivers [4], [5]. It can also increase trust and social ties among community members [6]. This prosocial behavior is manifested in the world as acts of kindness (AoKs). These acts can take many forms, such as donating to charities, and are influenced by a variety of psychological and social factors such as emotionality and social relatedness [7], [4], [8].

However, since behavior can be influenced by space [9], the design of digital technologies to foster kindness in spaces requires an understanding of the complex interplay between the physical and digital aspects of an environment, and the psychological and social factors that influence human behavior. This presents a significant challenge for software engineers who seek to design software that supports the creation of such technologies [10].

To tackle this challenge, we explore the notion of a *kind space*—a space intentionally designed to enable and foster kindness—and outline requirements for its design. Specifically, we identify two key requirements: *topology*, which pertains to the arrangement and relationships of entities within a space, and *psycho-social* determinants of human behavior, pertaining to kindness. These requirements are interrelated and can influence one another, and offer a potentially useful lens for understanding the complex interplay between digital and physical aspects of the space and the psychological and social factors that shape human behavior. We explore these two requirements, providing concrete examples and detailing their relations. To demonstrate our ideas, we present an example scenario of an office space that we use to inform the design of digital technologies that may contribute to the creation of a kind working environment.

II. Related Work

We examine studies that have investigated the influence of psychological and social factors on kindness, as well as research exploring the notion of space, its topology, and the utilization of digital technology to augment and enrich the lived experience in these spaces.

A. Kindness

As a prosocial behavior, kindness is influenced by a combination of psychological and social factors [7], [4], [8]. Psychological factors play a significant role in shaping individuals'

propensity for kindness, with emotional states, for example, impacting their likelihood of engaging in prosocial acts [11]. Personality traits also contribute, as individuals who possess higher levels of agreeableness tend to exhibit greater kindness in their interactions with others [12]. On the social front, the nature of the relationship between individuals, whether it be familial, communal, or with strangers, influences their inclination to perform acts of kindness [8], [13]. Level of need, including emotional or instrumental, can further motivate individuals to engage in kindness [14]. The interplay between such psychological and social factors can help understand the complex mechanisms underlying acts of kindness.

B. Space

Traditionally, a space is defined as a collection of entities characterized by their scales, shapes, and other physical properties [15]. In the context of human experience, spaces inhabited by individuals have a profound impact on their daily lives. As a result, a subfield within Geography has emerged to explore space from a humanistic perspective [16]. Consequently, the definitions of space have evolved. Chen and Paulsen, for example, extend the traditional understanding by emphasizing that spaces also set the stage for specific types of human behavior, such as how the entities within a workspace establish an environment conducive to professional conduct [17].

An important aspect of space is topology, which refers to the structural arrangement of its entities and their relationships [9], [18]. Topology encompasses two fundamental relations: containment and connectivity. It has played a significant role in analyzing and understanding various types of spaces, including both physical and digital [19], [20].

C. Digital Technology

While significant progress has been made in exploring the integration of technology with human emotions, there has been limited research specifically focused on kindness within computing [10]. Efforts related to empathic and affective computing paradigms have aimed to develop technologies that can understand and respond to people's emotions [21], [22], [23]. These endeavors have explored various applications such as emotion requirements engineering [24], affective feedback [25], and enhancing interpersonal communication [26].

However, these existing efforts have primarily focused on emotions and affective aspects, rather than explicitly addressing kindness as a specific construct. The exploration of topology has also been limited within the context of kindness in digital technology. Incorporating topology analysis could provide valuable insights for the design and development of technologies that foster kind interactions.

III. Kind Spaces

A *kind space* incorporates a collection of entities that possess distinct characteristics, such as topology and other design features, that create an environment conducive to promoting and enhancing prosocial behavior, including acts of kindness. This definition is derived from Chen and Paulsen's definition of space, which refers to a set of physical or conceptual entities that establish the context for specific types of human behaviors [17]. We envision kind spaces as an application area of the *kind computing* paradigm [10], proposed to explicitly consider kindness in the design and use of digital technology.

The concept of a kind space is not limited to physical environments and can be extended to both the cyber and physical worlds. In the *physical world*, it can be applied to physical spaces, where various components can be leveraged to promote kindness. For example, a whiteboard could be added to a physical space to allow individuals to write and share kind messages with others. In the *digital world*, the notion of a kind space can take advantage of its digital components. For example, a social media platform could enable its users to send virtual gifts to friends. The concept can also be applied to the *hybrid world*. For example, in a smart home, a smart TV could display prompts to encourage people to perform simple acts of kindness.

A kind space can play several roles in promoting and enhancing kindness. Specifically, it can function as a mediator, a giver or a receiver. As a *mediator* it can facilitate acts of kindness between individuals, acting as an intermediary between the giver and the receiver. For example, a chatbot that suggests kind actions to users when they interact with others on a social networking site. As a *giver* it can perform kind acts towards human receivers. For example, an automated system that senses an individual in distress within a workspace and sends a message of encouragement or offers a suggestion to improve their well-being. As a *receiver* it can be the recipient of acts of kindness from humans. recognizing and responding to these acts. For example, an individual may show appreciation towards a digital assistant, such as ChatGPT, for providing helpful assistance.

There are various combinations of world and role for a kind space, which potentially offer a wide range of research opportunities and challenges. In this paper, and to avoid over-anthropomorphizing spaces or the technologies they host, we focus specifically on *hybrid* spaces that behave as *mediators*. In such spaces, the boundaries between the physical and digital worlds are increasingly blurred and kindness is experienced across such boundaries. One example of a hybrid kind space is a smart building [27], which can play an important role in people's lives by serving as a home and/or a workspace. A kind home, for example, could have a wall clock that reminds a member to keep their voice and noise low as someone else is taking a nap in the next room. To explore the requirements for such kind spaces, we begin with a motivating example to illustrate their design challenges.

IV. Motivating Example: A kind Office

A company called "Dunder-Mifflin"[1] is planning to open a new branch. The branch space will be equipped with a

[1]A fictional paper and office supply sales company featured in the television series The Office (US) [28].

range of digital devices. A smart TV will be installed in the reception area, a coffee machine in the kitchen, a vending machine in the break room, personal computers in the offices, and a conference cam and smart TV in the meeting room. All the devices will be connected to an internal network, enabling them to interact and be controlled through digital processes (e.g., turning on/off the coffee machine). The branch will be managed by several individuals, including a receptionist, branch manager, and salespeople.

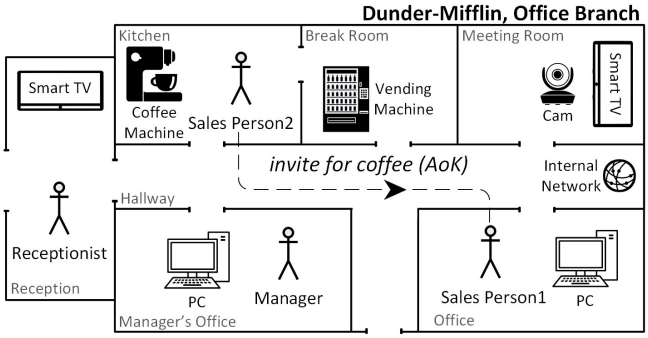

Fig. 1. A simplified smart space of our motivating example.

The company is aware of the negative effects of workplace incivility, such as declining performance and various mental and physical issues [29], [30]. To prevent and mitigate such issues, the company has decided to establish a policy that promotes kindness in the workplace. Kindness has been shown to enhance well-being and foster sociability and cooperation among people in the workplace [15], [31]. To achieve this goal, the company plans to leverage the smart space to mediate acts of kindness, such as inviting a coworker for coffee using the kitchen's coffee machine. The company has requested human operators, such as system administrators of the smart building, to identify acts of kindness that can be mediated by the space and to assess the state of kindness in the workplace.

However, the design of office space to foster kindness presents some key challenges. One is the many characteristics of kindness that are challenging to determine and measure [10], such as perceptions and expectations of what constitutes kind behavior. Another challenge is the distributed nature of digital devices and processes in a smart space that makes it difficult to determine how these devices can be leveraged to encourage and facilitate acts of kindness. For example, it may be difficult to identify opportunities in individual workspaces or remote areas of the building. The interconnection of smart devices and systems also means that acts of kindness may involve multiple devices or processes working together, making it harder to identify and track them.

V. Requirements for Designing Kind Spaces

The challenges in our motivating example suggest two key sets of requirements. The first is the explicit representation of psycho-social factors related to kindness. This entails capturing and incorporating the characteristics of kindness, such as cognitive, emotional, and behavioral concerns. The second is the explicit representation of the spatial topology within the design of a kind space. This involves considering the layout and arrangement of physical and digital elements in the space, and how they can influence and support acts of kindness.

A. Psycho-Social Factors

This set of requirements frames the psychological and social factors that drive kindness. Such requirements identify and represent the relevant psycho-social factors, such as emotionality and relatedness, and their relationships. The goal is to provide an understanding of these factors and their influence on kind behavior.

Psycho-social factors have been studied extensively in psychology and other social sciences. For example, studies like [14], [8], [7] have shed light on various factors that contribute to acts of kindness. In our motivating example, salespersons can invite each other for coffee, with psycho-social factors related to kindness, such as empathy and social connection, being the driving requirements.

Considering such requirements enable the development of strategies and interventions that promote kindness based on an understanding of the underlying psycho-social dynamics. For example, a library of psychological factors related to kindness can be developed and deployed, encompassing attributes such as emotions (with various enumerators, such as happy or sad) and their corresponding levels (such as high or low). Such representations enable the development of techniques that can reason about kindness in different psycho-social contexts, including reasoning about the emotions required for or influenced by acts of kindness.

B. Topology

This set of requirements emphasizes the importance of considering the spatial relationships and layout of spaces. It involves capturing the physical, digital and social topologies of the environment. The goal is to design spaces in ways that facilitate and encourage acts of kindness. This may include, for example, locating shared amenities or creating spaces that promote spontaneous interactions and a sense of community.

Various formalisms have been developed to represent and reason about topology, such as Ambient Calculus [32] and Bigraphical Reactive Systems (BRS) [33]. These formalisms have demonstrated their effectiveness in modeling and analyzing different properties and applications, ranging from security to emergency evacuation. In the context of designing kind spaces, existing formalisms may be leveraged to capture and reason about topological changes that impact acts of kindness. However, it is important to note that existing formalisms primarily focus on the cyber and physical dimensions of space, and incorporating psycho-social dimensions may require extending these formalisms to reflect such dimensions.

VI. Towards operationalising The requirements

To operationalize the requirements described in the previous section, we first need to decompose them further.

A. Psycho-Social Requirements

We identify three key requirements that (1) identify and categorize, (2) measure and assess, and (3) capture and represent, psycho-social factors.

Identify and categorize psycho-social factors. The aim is to systematically identify and categorize the psychological and social factors that influence kindness within a given space. This involves conducting in-depth research and analysis to understand the various aspects of human behavior and social interactions that contribute to acts of kindness.

To fulfill this requirement, researchers and designers need to engage with relevant literature, empirical studies, and psychological theories that explore the determinants of kindness. They must identify key psychological factors such as empathy and emotional states that can influence individuals' inclination to engage in kind behaviors.

Categorizing the identified psycho-social factors helps to organize and classify them based on, for example, their nature and impact. This categorization facilitates a comprehensive understanding of the range of factors at play and enables the development of targeted strategies for promoting kindness.

Measure and assess psycho-social factors. The focus here is on developing appropriate measures and assessment methods to capture the identified psycho-social factors. Software engineers can leverage and adapt measures from the field of social sciences to assess the identified psychological and social factors related to kindness [34], [35]. While there is no specific measure dedicated solely to kindness, measures of well-being developed in psychology can be adopted and adapted for this purpose [36], [35].

Capture and represent psycho-social factors. This involves developing representation models that can systematically capture and represent the identified psycho-social factors and their measures. Such models should allow for their integration into the design process and enable reasoning about their impact on promoting kindness. For example, software engineers can create a taxonomy that defines and categorizes different psychological and social factors related to kindness. This taxonomy can include specific dimensions or attributes of each factor, such as level and impact.

B. Topology Requirements

To operationalize topology requirements, we extend the notion of topology beyond traditional cyber-physical to include psycho-social. Topology, in this context, refers to the arrangement and interconnections of entities within a given space, encompassing physical, digital, psychological and social dimensions. To capture and leverage topology, we consider two requirements: modeling entities and their relations, and the incorporation of digital technology.

Model topological entities and their relations. The aim is to model entities that exist within the space, encompassing physical (e.g., rooms and workstations), digital (e.g., collaboration tools and virtual meeting rooms), psychological (e.g., emotions, traits) and social entities (e.g., teams and departments). It also involves capturing relationships of containment, such as rooms within a floor or teams within a department, and connectivity, such as corridors connecting different areas or the collaborative interactions between teams.

Representing and analyzing psychological and social entities in software engineering poses certain challenges. The existing modeling formalisms may need to be extended to accommodate their interactions. For example, the concept of social containment allows an actor to be part of multiple social groups that do not overlap. An individual, for instance, can be a member of a football team and simultaneously be a member of a research team, representing two distinct social groups. Modifying existing formalisms to capture such non-overlapping group membership is important for accurately modeling and understanding the dynamics of social interactions within the topological framework.

Incorporate Digital Technology. The emphasis here is on the integration of digital technologies into the space to augment kindness. Software engineers need to identify, select, and configure appropriate technological solutions that support acts of kindness. This may involve incorporating interactive displays, digital signage, communication platforms, or collaborative tools that facilitate virtual interactions and positive engagement among space inhabitants. By integrating digital technology, software engineers create an ecosystem that complements the physical environment and enhances social connections. This requirement mandates that software engineers consider the interoperability, usability, and accessibility of digital tools, ensuring they align with the overall design goals and promote a kind space.

VII. Scenario: Designing A Kind Office

We present a scenario focusing on the specific context of a sales office, based on our motivating example. We detail how each requirement can be further elaborated upon, offering a practical guidance for software engineers and designers in the creation of kind spaces within organizational settings.

The first key set of requirements focuses on gaining a comprehensive understanding of the psychological and social factors that impact individuals within the office environment. This task may initially seem daunting for software designers due to the multitude of factors to consider. However, our work helps *identify and categorize* the most relevant factors extracted from existing literature.

In pursuit of this objective, we conducted an extensive literature analysis to identify the factors that are relevant to kindness. Through this analysis, we identified five psychological factors and five social factors that have been consistently associated with kindness in previous research. These are depicted in Fig. 2.

The five psychological factors include *motivation*, which is the drive to perform an act [4], [7]; *emotionality*, which refers to the emotional state of an individual (such as happy, sad) [11]; *self efficacy*, which indicates beliefs that people hold about their capacity to control events in their lives (such as beliefs in expressing positive emotions) [37], [12]; *character traits* indicate dimensions of personality [38], such as openness

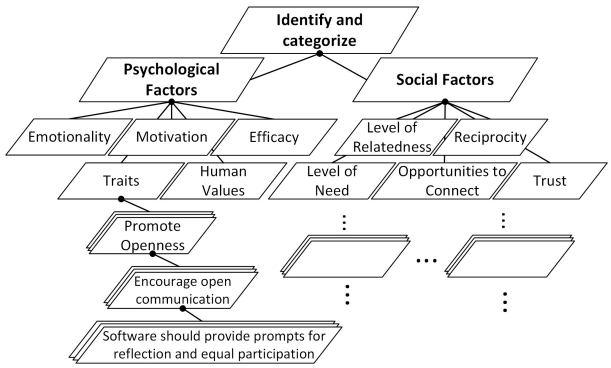

Fig. 2. Psychological and social factors commonly linked to kindness, contributing to the design of kind spaces.

and agreeableness [12]; and *human values*, which are guiding principles in people's life [39], such as benevolence and universalism [12].

The five social factors that are closely linked to kindness include *level of relatedness*, which reflects the closeness between a giver and a receiver such as family, colleague or stranger [8], [13]; *level of need*, which indicates the type of need a receiver has such as emotional (e.g., consoling a grieving person) or instrumental (e.g., needing help to move to a new place) [14], [7]; *opportunity to connect*, which indicates possible opportunities that a giver may gain from being kind such as strengthening a relationship with a family member or making a new friend [40]; *reciprocity*, which can drive a giver to perform kindness as a repay to an AoK that the receiver had previously acted towards the giver [4]; and *trust*, which has been shown to increase between giver and receiver of acts of kindness [6].

Designers, for example, can zoom in on *Traits* such as openness. They can further specify behaviors that promote openness in the sales office, such as encouraging open communication and active listening among team members and creating an inclusive environment where diverse opinions are respected. Designers can then leverage digital technology and software to promote open communication in a kind office. For instance, they can develop and use software solutions that incorporate features to encourage active listening, such as providing prompts for reflection and ensuring equal participation in discussions, as shown in Fig 2.

Designers also need to address the possible ways to *measure and assess* these factors in the sales office environment. Our work provides insights into possible measurement approaches and emphasizes the importance of creating specific measures tailored to the sales office context. For instance, to assess overall well-being, models such as PERMA [36], which is widely used to measure different aspects of well-being, can be utilized. Designers can also employ the Big Five trait taxonomy [41] to measure personality traits relevant to kindness. However, metrics specific to kindness are lacking. For this scenario, the requirement of *measuring and assessing* kindness can be specified as shown in Fig. 3.

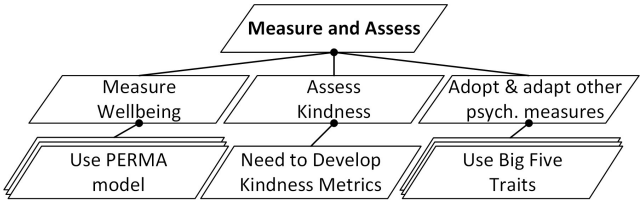

Fig. 3. Potential measures to assess psycho-social factors.

The third aspect that designers need to address is how to *capture and represent* these factors. One of the major challenges in this regard is the lack of suitable representations to effectively capture and represent these psycho-social factors [10]. Our work emphasizes the need for enhanced representations and proposes potential approaches to address this gap, such as the development of meta-models specifically designed to represent the identified factors.

The second key set of requirements concerns the development of a comprehensive understanding of the topological setting of the sales office, encompassing both the cyber-physical and psycho-social dimensions. Our work can provide guidance on identifying and categorizing these entities based on the psychological and social factors requirements. For example, traits and motivation of sales personnel could be captured within the topological model to understand their influence on individual behavior and interactions. Figure 4 provides a visual representation of the topological model for our example office, showcasing the presence of both social and psychological entities. It highlights the containment and connectivity of physical entities, such as rooms and devices, while also incorporating social entities, such as the SalesTeam, and psychological entities, including Motivation and Traits.

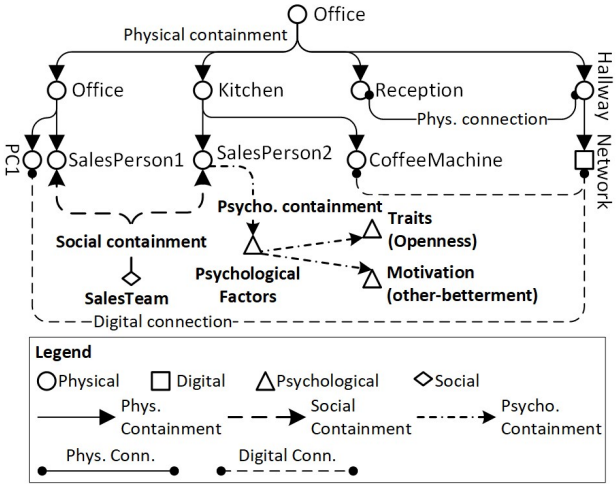

Fig. 4. A partial representation of the office topology of our motivating example (see Fig 1).

VIII. Conclusion & Future Work

We have explored the requirements for designing kind spaces, focusing on the psychological and social factors that

influence kindness, as well as the importance of considering topology and incorporating digital technology. We also highlighted emerging research challenges in designing kind spaces, such as the need to develop metrics and models for kindness.

Future work will focus on further specifying and implementing the requirements in key application areas. This involves conducting empirical studies to validate the effectiveness of the identified factors and exploring innovative design solutions that integrate digital technologies to enhance kindness. Additionally, collaboration between software engineers, psychologists, architects, and other stakeholders is crucial for developing comprehensive guidelines and methodologies for designing kind spaces.

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