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INDIVIDUAL INNOVATION AND CREATIVITY

An Interdisciplinary Mapping of Creative Cognition

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Creativity is a recognized essential driver for innovation, growth, job creation, and social development (Skippington, 2016). Studies of individual creativity span both lab-based and survey-based studies of creative cognition and real-world business-oriented creative practice and innovation, where organizations and governments rely on individuals to collect ideas for new products (with tangible or intangible boundaries) and to inform business or policy-making interventions. An illustrative example from the commercial sector is that of a biotechnology firm that managed to resolve a complex problem in computational biology only through the input of creative individuals external to the organization (Lakhani et al., 2013). Likewise, the 2010–2013 earthquakes in Christchurch, New Zealand, or the initial 2020–2021 COVID-19 global lockdowns are examples of sharp disruptions to the environment that saw individual creativity being leveraged to provide instant solutions in shock moments without threatening the overthrow of law (Cameron et al., 2018; Sakellariou et al., 2021). Hence, at the beginning of the COVID-19 outbreak and in the lack of manufactured hand sanitizers and face protective masks, many community hospitals and nearby communities relied on creative individuals to develop and distribute homemade hand sanitizers with grain alcohol and softeners like aloe vera and 100% cotton double-fabric masks (Chesbrough, 2020). Most importantly, such individual creative process engagement during the crisis has been found to be positively related to self-reported creative growth and a higher level of flourishing human well-being (Tang et al., 2021). Creativity is a key phenomenon that is studied in various subdisciplines of the social and psychological sciences. The lack of interdisciplinary collaborations may result in different conceptions of creativity coexisting in these subfields. To begin addressing this issue, we ask to what extent and how the innovation management and human experimental psychology research streams overlap, both in terms of their conceptualization of innovation and creativity as well as in terms of the methods employed to study creativity. We anticipate that the evidence on human creativity stemming from these two streams of research is likely to be multifaceted and to originate from a heterogeneous set of studies, calling for a systematic mapping of the research base rather than a systematic review and synthesis of results.

The objective of this scoping review is to identify what influences creative behaviours (both at the individual level and at the contextual level) and to synthesize the approaches

DOI: 10.4324/9781003009351-47

used to study creativity (i.e., how is creativity operationalized and measured?). This will allow us to determine what assumptions underpin the study of creative cognition and behaviour in two distinct but possibly overlapping research areas. In addition, this will allow us to identify suitable topics or sub-groups of evidence that may be suitable for further meta-analytic research and knowledge gaps for primary research informing interventions to stimulate individual creative cognition and user innovation.

In the first section of this chapter, we present the methodology that we used to identify the papers we included in this scoping review. We opted for a scoping review method as opposed to a standard narrative review to guard against biased selection and increase the transparency and replicability of our conclusions (Haddaway et al., 2020). Next, we present and discuss the synthesis of the selected studies in innovation management, mapped against five higher-order categories of creative behaviour antecedents identified in previous research on user insight in innovation management (Sakellariou et al., 2020): topos (physical/virtual space), demos (demographic characteristics), logos (pre-existing abilities and personality traits), pathos (emotions), and ethos (values and motives). In the third section of this chapter, we present and discuss the synthesis of the studies selected in human experimental psychology. Experimental psychology is concerned with testing theories about psychological processes and traditionally uses a hypothetico-deductive approach to study behaviour. We aim to map the experimental studies against the five higher-order categories of creative behaviour identified in the user innovation management literature where possible. We conclude with a closing section of this chapter where we discuss the insights arising from this collaborative mapping exercise, the gaps identified, and suggest possible directions for future research.

Scoping Methodology

Following existing guidelines for systematic reviews and systematic mapping (Collaboration for Environmental Evidence, 2013; James et al., 2016), a scoping study was undertaken as part of the development of this protocol for the scoping question "what are the individual and contextual factors which underpin creative behaviour?". The process involved trialling and refining search terms in the APA PsycInfo® database, the Web of Science, and the EBSCO Business Source Premier database.

Stage 1: Developing the Systematic Map Protocol

The first stage of a scoping review begins with establishing a review team, which includes members with the required knowledge and skills for carrying out a systematic map (James et al., 2016). The present review team included the first author (GVT) with expertise in cognitive psychology, creative thinking, and decision-making (e.g., Henok et al., 2020; Vallée-Tourangeau et al., 2015; Weller et al., 2011) and experience of literature searching and coding (e.g., Thomson et al., 2015); the second author (ES) with experience in user innovation and creativity and innovation management (e.g., Sakellariou et al., 2020; Sakellariou et al., 2017; Sakellariou et al., 2014); and a research associate (FS) with expertise in occupational psychology who worked under the supervision of the two academic leads. This study was funded by Kingston Business School, Kingston University London. The funder was not involved in developing the protocol.

Next, the scope was set by GVT and ES. The heterogeneity of the studies in our respective fields precluded the possibility to conduct a systematic review, so we kept the scope open and set the objective of this mapping as comparing the types of antecedents of creative

cognition and behaviour studied in two distinct research areas: on the one hand, user innovation in innovation management, and on the other hand, creativity in human experimental psychology. More specifically, we formulated the following systematic mapping question:

> *What individual and contextual antecedents of creative cognition and behaviour have been identified in healthy adults (≥ 18 years of age) in the recent literature (01/01/2016–30/04/2021)?*

Eligibility and Inclusion Criteria

Since we wanted to explore the conceptualizations of creativity and creative behaviour, we purposely did not specify a definition of creativity as an eligibility criterion but instead included any study measuring the production of a creative response or outcome. We soon realized that we needed to use discipline-specific eligibility criteria for the innovation management literature and the human experimental psychology literature to retrieve a manageable and relevant set of research outputs in each field due to differences in keywords, journals, and databases used by researchers in these respective disciplines.

As our research question was open-framed, seeking to scope the various antecedents of creative behaviour documented in the literature, our inclusion criteria were quite broad and included studies of healthy adults (≥ 18 years of age) producing a creative or innovative response or outcome and investigating the antecedents or correlates of creative or innovative responses or outcomes.

Scoping of User Innovation Studies

The present review includes peer-reviewed journal articles on user innovation published between 01 January 2016 and 30 April 2021. Searches were carried out in two databases: Web of Science and EBSCO Business Source Premier. Following an exploratory literature review, two keywords were established, namely "user innovat*" and "lead user*." Searches were limited to the English language and to words in the title, abstract, and/or keywords only.

A total of 448 papers (304 from the Web of Science and 144 from EBSCO Business Source Premier) were identified and stored in a local database. Of those, 104 papers were duplicates and were excluded. The remaining 344 papers were first screened for their relevance based on their titles and abstracts.

The excluded manuscripts included: studies of children (<18 years old); studies that did not measure individual creativity or innovation, and studies that did not investigate antecedents or correlates of creativity or innovation. Furthermore, studies of group creativity or co-creation (i.e., involving more than one individual in producing a creative response or outcome) and studies of training or human intervention effects (i.e., use of monetary rewards to stimulate creativity) were also excluded. A total of 32 studies were included in the review. See Figure 42.1 for the detailed exclusion flow using the PRISMA2020 R Package (Haddaway et al., 2021).

Scoping of Creative Cognition Studies

We searched the APA PsycInfo database using the subject terms *SU creativ* innovat*, limited to peer-reviewed journal articles categorized under the APA PsycInfo Classification Code 23* (Human Experimental Psychology) published between 01 January 2016 and 30

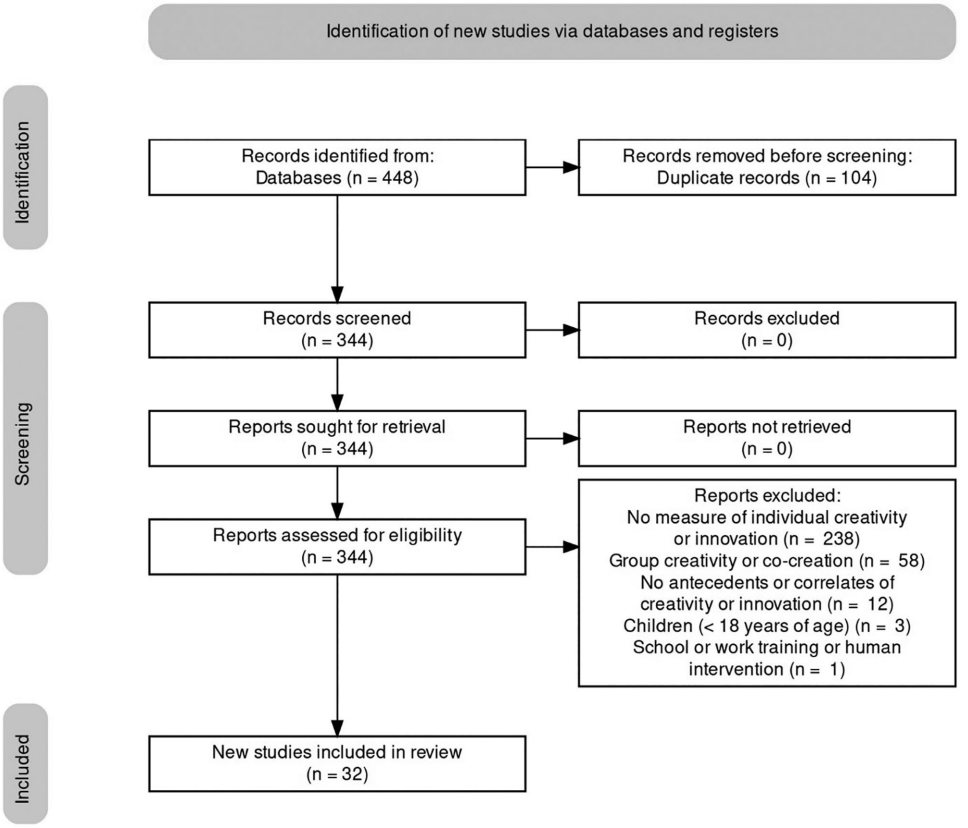

Figure 42.1 Flow diagram for selecting user innovation studies

April 2021. This resulted in 213 articles. One report had no digital object identifier and could not be retrieved. We assessed 212 reports for eligibility. A manual screening of titles and abstracts and, if necessary, full reports resulted in 107 excluded articles and 105 eligible studies, a much larger sample than the sample identified in the user innovation literature. Since this was a scoping study rather than a systematic literature review, and since our main aim was to sketch a comparative overview of research in both user innovation and creative cognition, we then excluded reports published prior to 2019. This resulted in 39 studies being included in the review. See Figure 42.2 for the detailed exclusion flow and reasons for exclusions created using the PRISMA2020 R Package (Haddaway et al., 2021).

Creative Behaviour in User Innovation Research

In the innovation management stream of literature, individual creative behaviours that result in proposing new ideas for products are referred to as "*user innovation.*" It integrates the concept of *individual creativity* (i.e., the idea or solution generation) with the concept of *individual innovation* (i.e., the implementation of ideas or solutions towards new and improved processes, practices, services, or objects[1]). In this context, individual creativity and innovation is a self-initiated, deliberate, and self-funded action that occurs independently of the organization. This type of action focusses on new functions of an existing product

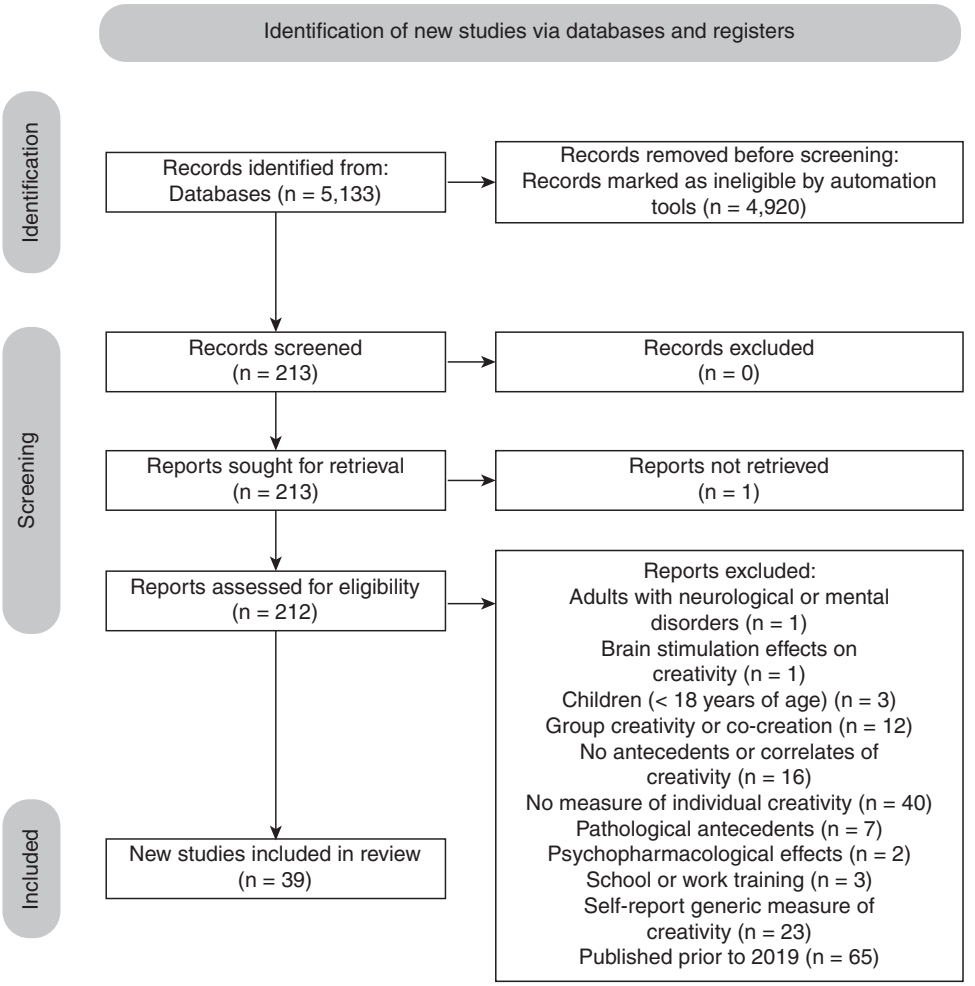

Figure 42.2 Flow diagram for selecting experimental psychology studies of creativity and innovation

or the development of a breakthrough product when the product that would normally be applied for a specific task is unavailable, defective, or inappropriate (Faulkner & Runde, 2009).

Innovating individuals can be classified as *lead users*, that is, those who face needs in a specific product or service domain much earlier than the rest of the market and benefit significantly by developing a solution to those needs (Thomke & Von Hippel, 2002), and *ordinary users*, that is, those with limited technological knowledge of a product or service domain who generate solutions to satisfy their personal needs (Kristensson et al., 2004). When the novel outcomes of the users' innovative endeavours are self-reported or elicited by organizations, they have the potential to make a significant contribution to enhance innovativeness in: (a) online communities (Tirabeni & Soderquist, 2019); (b) living labs, where users interact with products and typical situations (Schuurman, 2015); (c) academic research environments (Moretti, 2019); (d) organizational co-creation processes; and (e) an entire industry (Baldwin et al., 2006).

The reported number of innovating users of the ordinary type, however, is extremely low (less than 6%); this is because these individuals rarely share or promote their ideas (Stock et al., 2015). Although traditional market research can indeed elicit users' ideas and solutions (Fursov et al., 2017), only half of these users report their creative outcomes in these types of studies (Hienerth et al., 2014), and they prefer to share their ideas with their peers, friends, or families (Conradie et al., 2017). So, there is limited understanding in the innovation management stream of literature about the creative behaviour of ordinary and lead users and its antecedents. In the following sub-sections, we contribute to filling this gap by mapping the 32 studies we identified through our scoping search against five elements that contribute to creative behaviour (Sakellariou et al., 2020): topos (physical/virtual space), demos (demographic characteristics), logos (skills and experience), pathos (emotions and personality), and ethos (values and motives).

Topos: Physical/Virtual Space

Individual creativity and innovation occur mainly in the space (topos) that the innovators perceive as their own. Personal space is considered by these individuals as more intimate and familiar, and it, therefore, provides a safe and comfortable context for the generation of new ideas (Sakellariou et al., 2020). This space can be either: (a) physical, when it embodies the living (home or leisure) real and tangible environment; or (b) virtual, when it involves the simulated, three-dimensional digital setting (Svensson & Hartmann, 2018).

In their own physical space, innovating individuals lead their everyday lives through robust daily practices. Such practices may be interrupted by unforeseen or repetitive challenges and constraints that can stimulate individual experimentation and a change of routines (Jalas et al., 2017). These individuals create novel interventions to resolve problems and perform their daily tasks unobtrusively (Lukoschek & Stock-Homburg, 2021). A highly constrained physical space enforces inhabitants to create solutions to facilitate their daily chores. For example, because the living environment has primarily been designed for individuals without disabilities, disabled individuals often become user innovators by refining or adapting existing products and services to meet their specific needs (Conradie et al., 2017).

Although individual innovation is considered a more intimate and independent activity because it is manifested in the individuals' own physical surroundings, it is occasionally leveraged by the engagement in a greater range of practices in the wider collective spaces such as local communities and co-working environments (Fursov et al., 2017). This is evidenced in the healthcare sector, where issues in daily health practices and access to real-world maker spaces have stimulated health practitioners to become user innovators and to inform user-centric policy interventions (Svensson & Hartmann, 2018).

The importance of maintaining a sense of space ownership in individual innovation is also prevalent in the virtual context. Virtual platforms and content ownership in the digital world have strong implications for user innovation success (Zhou et al., 2018) because they allow for design autonomy (decision-making autonomy, scheduling autonomy, and work method autonomy) that in turn fosters user creativity and innovation (Ye, 2018). However, creative autonomy and the safety of one's own setting for innovation entail practical challenges. As the virtual space is neither physical nor tangible, idea exploration and implementation can be complex and difficult, and creative interventions are better facilitated by functional support such as technical mobile toolkits (Wang & Li, 2016) and emotional support from the social network (Qi et al., 2021). Well-connected creative individuals who interact with virtual

neighbours (Yang et al., 2020), domain experts, and families and friends can generate and develop innovative ideas with higher market success (Hamdi-Kidar & Vellera, 2018).

Demos: Demographic Characteristics

Research has only recently focussed on the demographic characteristics that influence user innovation. Gender seems to play a key role in the type of solution development. Some studies suggest that men are more likely to innovate in the healthcare, computer software and hardware, and consumer sectors (Chen et al., 2020; Fursov & Thurner, 2017; Oliveira et al., 2019), while women tend to develop lower-priced substitutes of existing products related to arts, crafts, and gardens (Fursov & Thurner, 2017). Although these studies provide interesting insights, they may present a narrow view of the impact of the different genders on individual creativity and innovation due to their geographical sample bias. For example, the Fursov and Thurner (2017) study was conducted in Russia, where men and women tend to be occupied in distinct types of jobs and industries (e.g., construction vs. childcare), and where women have limited opportunities for career progression and focus more on housekeeping, which may impact the type of their innovation development.

Income is another antecedent for individual creativity and innovation, as individuals with higher incomes have the potential to focus on creative activities having already met their basic physiological and safety needs (Chen et al., 2020). Recent studies have demonstrated that old age is negatively correlated with individual innovation, especially in the technology and industrial sectors (Fursov & Thurner, 2017; Grosse, 2018), perhaps because more mature adults are less familiar with the new technologies. Another interesting finding is that education and youthful age are positively associated with innovation activity (Oliveira et al., 2019); young adults are engaged in innovation efforts as a means to improve their skillset further to their recent education and to lead the way to entrepreneurial or managerial careers (Fursov & Thurner, 2017).

There are other human physical characteristics that enhance the development of creative solutions that would assist the effective interaction with the social and material worlds; this is the case for individuals who suffer from medical conditions and physical or cognitive impairments and who often improvise home or health-care solutions to facilitate their everyday lives (Cantin et al., 2020; Conradie et al., 2017).

Logos: Pre-Existing Abilities and Personality Traits

Ordinary users are characterized by pre-existing domain-related abilities; they have accumulated medium- or high-task-related experience because they make use of specific products or services and perform practice-based routines in their daily lives (Sakellariou et al., 2020). Some of these individuals have also acquired domain-specific skills; this set of skills is a combination of personal background and experience that enable them to carry out a task within a certain area efficiently (Schweitzer & Hende, 2017). A medium level of domain-relevant skills has a positive impact on the novelty of the ideas (Mack & Landau, 2020). The skills and experience acquired at work provide additional valuable resources for home- or leisure-related innovation (Jalas et al., 2017; Wu et al., 2020) and impact positively innovation outcomes in terms of novelty, general use value, and technical feasibility (Lukoschek & Stock-Homburg 2021).

Lead users possess technological knowledge and are characterized by leading-edge status and creative self-efficacy (Wang & Li, 2016). These types of innovating individuals develop a particular skill termed technological reflectiveness, which is the ability to think about the wider economic, cultural, and societal impact of a particular product or service (Schweitzer

et al., 2015). Technologically reflective users accumulate knowledge by eliciting information and using experience with technological products and services, then reflecting on the wider impacts of their usage. Through these considerations, the lead users gain a deeper and novel understanding of a domain (Schweitzer & Hende, 2017) and are able to link knowledge about needs and solutions (Schweisfurth, 2017). This is potentially one reason the lead users seem to outperform the ordinary users in generating and developing innovative ideas that succeed in the marketplace (Hamdi-Kidar et al., 2019).

Besides knowledge, user innovators personality traits were also found to be associated with innovation. For example, a quantitative survey of 547 innovating German consumers explored the links between personality traits, successful idea generation, and the development of a prototype that implemented that idea. Specifically, the personality traits associated with success differed for each task. Consumers who scored higher on openness to experience were more likely to have new product ideas, while those who were introverted and conscientious were more likely to succeed on the prototyping tasks. (Stock et al., 2016).

Pathos: Emotions

Emotions related to the task trigger or inhibit individual creativity and innovation. The individual experience of a problem generates negative feelings of dissatisfaction, often described as annoying or frustrating. For example, when discussing innovation in cooking, a user-innovator explains, "when it doesn't work, I'm very frustrated and I feel like there is no point in, in doing it but again, I will continue to cook because I know that they have to have good food." (Sakellariou et al., 2020, p. 7). Such instantaneous negative emotions rarely lead to creative actions. It is the recurrence of the negative feelings related to a re-emerging problem over longer periods that motivates individuals to remove their uncomfortable emotional states by trying to provide a resolution. In contrast, neutral feelings related to a task, such as boredom or dullness, for example, do not seem to trigger user innovation because any arising problems related to dull tasks are considered unimportant (Sakellariou et al., 2020).

Although the efforts to resolve an issue are sparked by the persistence and repetitiveness of painful emotions, it is positive feelings that enhance and cultivate experimentation endeavours; creative individuals may tinker around, try, and test alternative solutions, sometimes only to experience feelings of enjoyment and pleasure (Brinks, 2020). This is due to the strong focus on exploration and learning that these individuals have, which is not always beneficial to generating usable and sometimes not even novel ideas (Mack & Landau, 2020). During the moments of discovery, positive emotional states reach their peak (Morris & Ashdown, 2018). Feelings of euphoria accompany the resolution of tension when a problem is finally resolved and then gradually fade away. Memories of such pleasurable emotional experiences can encourage individuals to continue their innovation efforts, which underlines the importance of emotional involvement as an incessant part of the creative process. Occasionally, a repeated interaction with the product-related problem-solving task takes the form of "captivation" or "obsession," which absorbs and disconnects the innovating individual from the outside world. Some authors argue that innovating individuals prefer to be isolated and pursue their creative efforts alone (Morris & Ashdown, 2018).

Ethos: Values and Motives

Extrinsic motives such as external rewards and gains are usually present during the diffusion and commercialization of innovation, but they rarely trigger the initiation of individuals'

own creative and innovation activities (Chen et al., 2020). The primary reason for user creativity and innovation is the fulfilment of the individuals' personal needs in relation to existing products or services (Koch & Guceri-Ucar, 2017). So, the innovating individuals aim to gain personal use value, that is, to increase their own personal benefit, by resolving unforeseen interruptions during their practice of daily tasks. A study in the high-technology sector (Grosse, 2018), for example, suggested that lengthy implementation times and data concerns enforced users to create their own technological solutions to resolve these challenges.

However, the emergence of in-use problems that call for a solution does not suffice to stimulate creativity among all innovating users. Social use values such as caring for others and the willingness to contribute to society or protect the environment can enhance individual-generated solutions (Chen et al., 2020; Hamdi-Kidar & Vellera, 2018; Sakellariou et al., 2020). Moreover, an entrepreneurial mindset and the conviction that innovation activities can make a difference in one's life can inspire individuals to act creatively (Ghasemzadeh et al., 2020; Morris & Ashdown, 2018).

Synthesis of Current Trends in User Innovation Research

The synthesis of the findings of the scoping review of the user innovation literature reveals that, at the individual level, creativity and innovation are influenced by the demographic characteristics (demos) of the ordinary/lead users, they require a repository of domain-related skills and experiences (logos), are triggered by an impetus, and occur in a "cocoon nest." The individual's positive or negative emotional states over a period of time and their specific personality traits (pathos), accompanied by a set of purposeful values and motives (ethos), act as an impetus that enhances creativity and innovation activities. The four antecedents of demos, logos, ethos, and pathos extend the componential creativity model (Amabile & Pratt, 2016) that suggested three major components contributing to individual creativity, including expertise, creative-thinking skill, and intrinsic motivation. The review findings show that the safe and comfortable physical or virtual space (topos) is nesting the individual's regular practice of their routines, improvisations, and experimentations.

In contrast to influential organizational creativity research that advocates the importance of the external environment for individual creativity, including the managerial practices of the organization that feed (or starve) an employee's creativity (Amabile & Pratt, 2016), recent research suggests that individual characteristics of ordinary or lead users play a pivotal role in initiating and progressing creative outcomes. The creative and innovation process is rather esoteric, as it is initiated by the individual independently of any organizational brief or task (Morris & Ashdown, 2018; Stock et al., 2016), and the interaction with the external environment to access resources, support, feedback, or inspiration is originated by the individual only when necessary (Fursov et al., 2017). The focus lies on the dialectic between the product and the innovator, which deepens through time (Brinks, 2020). It is possible that this process enhances the individual's ability to be immersed in a situation of creating novel solutions and experiment with their application in a virtual environment. Previous studies have showed that, during concept development, individuals who are able to be transported through storytelling aimed to create vivid mental images of novel product concepts feel fully immersed in the situation. As a result, their attention and thoughts are focussed solely on this mental experience, enabling them to envisage innovative ideas and enumerate their advantages and disadvantages (Schweitzer & Hende, 2017).

The review synthesis shows that the interplay among the five antecedents (demos, pathos, logos, and ethos within the topos) is complex and dynamic, and their joint influence results

in an individual action that is creative and central to a habitual activity at the same time. This finding bridges the problematic dichotomy between habit and creativity initially discussed in the model of individual (employee) creative action (Ford, 1996). In time, habitual practice builds knowledge and expertise that, in turn, is channelled towards the efforts to resolve problems and issues that matter to the individual. On the other hand, because the creative solutions serve the individual's own purpose, this inner activity often remains within the closed boundaries of the topos and is not externalized. Educational institutions, organizations, and governments should lean towards this untapped pool of creativity by providing risk-averse opportunities and incentives to make such implicit innovations explicit and to advance collective knowledge and an entrepreneurial mindset.

Creative Behaviour in Human Experimental Psychology Research

The aims, settings, and hypothesized antecedents of studies of creative behaviour in human experimental psychology research offer, unsurprisingly, striking differences as well as some similarities with studies of creative behaviour in user innovation. We used the same broad overarching categories to organize our mapping and review the environmental antecedents (topos), individual characteristics (demos), pre-existing abilities, skills, and personality traits (logos), cognitive and emotional states (pathos), and attitudes, values, and motives (ethos). We also identified another dimension, distinct from the influence of where individuals are, who they are, what they know or can do, how they feel, or what they believe in, on their creative performance. We labelled this last dimension *praxis* (actions, habits, and behaviours) to refer to the actions or habitual behaviours participants engaged in during the creative process.

Topos: Contextual and Environmental Influences on Creative Behaviour

Reports that examined the influence of contextual variables on creative behaviour fell into two types: those that examined peripheral influences that were not directly related to the creativity task and those that examined direct influences aiming to enhance the creative production process. Peripheral influences included visual, cognitive, or olfactive primes (Akben & Coskun, 2019; George et al., 2021; Madjar et al., 2019; Wu & Koutstaal, 2020; Yu, 2020; Zuo et al., 2019). For example, Zuo et al. (2019, Experiment 1) tested the impact of an unrelated cognitive prompt on creative performance. They first primed participants by asking them to describe either a stereotypical target (e.g., male governor) or a counter-stereotypical one (e.g., male nurse). Participants were then asked to design a poster. Creative performance was assessed by asking three independent postgraduate students, blind to the priming conditions, to assess the creativity of the poster designs. Creativity ratings for posters designed after a counter-stereotypical prime were rated as more creative. Visual priming included the provision of photographs (George et al., 2021), paper-based tasks printed on green, red, or white paper (Yu, 2020), or the provision of ambiguous visual figures that could be interpreted in two ways, such as the young girl/old woman figure prior to the completion of a creative task (Wu & Koutstaal, 2020). An original study also examined the influence of the perception of movement in one's environment (i.e., sitting on a moving or static train in a virtual environment) on divergent creativity (Fleury et al., 2020).

Most tests of direct influences included cognitive prompts aiming to change participants' focus of attention, such as creativity versus fluency (Taylor, 2021), ideas versus constraints (Bonnardel & Didier, 2020), avoiding unoriginal ideas (George & Wiley, 2020), probing

open-ended or focussed thoughts during incubation (Steindorf et al., 2021), or reducing mental fixation using a multi-item alternative use task (George & Wiley, 2019). Finally, other studies focussed on changing participants' cognitive processing to influence creativity, for example, by prompting fast processing speed (Forthmann et al., 2020), comparing forced and spontaneous memorization processes (Kurashige et al., 2019), or training participants to improve their forecasting skills (Todd et al., 2019).

Perhaps not surprisingly, we also noted that none of the reports that focussed on contextual or environmental influences examined the situational context within which the creative process took place. Apart from one remote study using MTurk participants (Taylor, 2021) and one study presumably testing participants in a classroom context (Bonnardel & Didier, 2020), most studies took place in laboratories on university campuses, with participants completing computer-based tasks (Forthmann et al., 2020; George & Wiley, 2020; George et al., 2021; Kurashige et al., 2019; Wu & Koutstaal, 2020; Yu, 2020) or paper-and-pencil tasks (Akben & Coskun, 2019; Steindorf et al., 2021; Todd et al., 2019; Yu, 2020; Zuo et al., 2019). In most cases, it was unclear whether participants completed the creativity tasks in isolation or alongside others (Akben & Coskun, 2019; George & Wiley, 2020; Kurashige et al., 2019; George et al., 2021; Steindorf et al., 2020; Taylor, 2021; Wu & Koutstaal, 2020; Yu, 2020). When reports provided contextual information, they specified that participants could either be tested alone or in the presence of others (e.g., Forthmann et al., 2020). Only one study specified that participants' creative behaviour was tested in isolation (Zuo et al., 2019). Whether this aspect of the procedure might moderate creativity remains an open research question, but we note how sharply these practices contrast with the user-innovation literature reviewed above, where the context of creation is conceived as a key element for fostering creative performance.

Demos: Demographic Characteristics

Only one report in the sample examined the influence of demographic characteristics on creative performance and the impact of age on creative writing (Leon et al., 2019). This study aimed to investigate differences in performance between young and older adults in the production of an original story using three unrelated common words. The participants were 30 younger (aged between 18 and 30 years old) and 30 older adults (aged between 65 and 80 years old). Three judges rated the resulting stories for originality, appropriateness of the story structure, cohesion, organization, and overall impression. The evidence revealed that age had a significant impact on all creativity measures after controlling for verbal and cognitive ability, suggesting that ageing may have an adverse impact on verbal creative ability.

Figure 42.1 illustrates that the average age across studies was skewed towards younger adults while the male/female gender ratio varied a lot across experiments, with some experiments run exclusively with female participants (Bonnardel & Didier, 2020, Meier et al., 2020) and others including a large majority of men (Hagtvedt et al., 2019, Hüttermann et al., 2019).

As is usually the case in experimental psychology, most of the reported experiments were conducted with university students (40 of 61, 66%), and in most cases, there was no further information about their occupational field (16 of 40, 40%) or whether they were psychology students (14 of 40, 35%). Other experiments examined creativity among business students (4 of 40, 10%) or students pursuing other fields of study such as communication, computer science, design, or teaching (6 of 40, 15%). In the non-student samples, there was often no information about their occupational field (11 of 61, 18%). Only five reports out of the 40 sampled examined creativity among professional creators who either worked in the arts

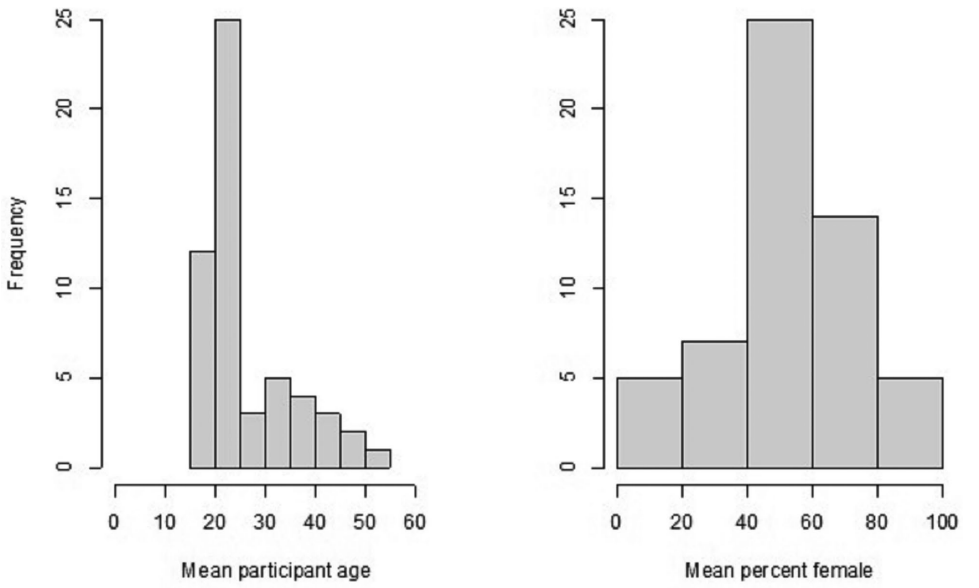

Figure 42.3 Distributions of ages and genders in experiments

and crafts industry (either as artisans, Hagtvedt et al., 2019, or as musicians, Palmiero et al., 2020), as professional writers or physicists (Gable et al., 2019), in the hospitality sector (either as chefs or waiters, Kapadia & Melwani, 2021), or in the sports industry (as football players, Hüttermann et al., 2019). Figure 42.4 provides an overview of the areas and occupations of the various samples used.

The set of selected studies published since 2019 (n = 39) originated from 16 countries (see Table 42.1), mostly from America (41%), followed by Asia (31%), and Europe (28%).

Whether these demographic characteristics (or their cultural underpinnings) moderate creativity remains an open question. Relatedly, the absence of representation from the Middle East and Africa may also be worth exploring to provide a more global understanding of the antecedents of innovation and creative behaviour.

Logos: Pre-existing Abilities, Experiences, and Personality Traits

Only one study included a measure of personality – openness to experience – as a predictor of creative behaviour (Friis-Olivarius & Christensen, 2019). The rest of the studies examining the influence of pre-existing abilities on creative behaviour focussed on basic cognitive abilities, cognitive processing abilities, and language abilities. The basic cognitive abilities examined included attentional mechanisms, cognitive flexibility, and broader measures of cognitive abilities. Attentional control abilities were examined through selective attention, defined as the ability to initiate and maintain focus on relevant information and filter out the rest (Menashe et al., 2020), or the shape of visual attention focus along the horizontal, vertical, and diagonal meridians (Hüttermann et al., 2019). Two studies also examined the impact of inhibitory control, or the ability to suppress pre-potent responses (Menashe et al., 2020; Zabelina et al., 2019). Cognitive flexibility was operationalized as the ability to attend to divergent perspectives (Kapadia & Melwani, 2021), to engage in divergent thinking and produce a diverse range of responses (Friis-Olivarius & Christensen, 2019; Menashe et al., 2020), and the

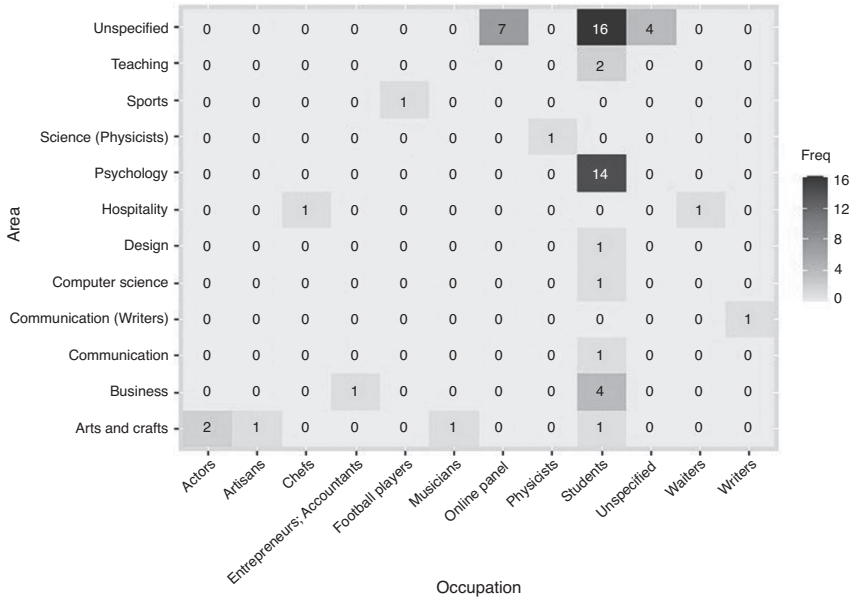

Figure 42.4 Overview of participant samples

Table 42.1 Distribution of experimental psychology studies on creativity and innovation across the globe in the past five years (January 2020–April 2021)

Sub-Region	*Country*	*Count*
America (16)		
Northern America	United States	15
South America	Colombia	1
Europe (11)		
Northern Europe	Denmark	1
Western Europe	Germany	4
	France	2
	Netherlands	1
	Switzerland	1
Southern Europe	Italy	1
Eastern Europe	Poland	1
Asia (12)		
Western Asia	Israel	1
	Turkey	1
South-Eastern Asia	Singapore	1
Southern Asia	India	2
Eastern Asia	China	4
	Hong Kong	2
	Japan	1

ability to shift between two concurrently presented items (Wu & Koutstaal, 2020) or between different tasks and mental sets (Zabelina et al., 2019). Broader measures of general intelligence included measures of working memory spans (Dygert & Jarosz, 2020; Menashe et al., 2020; Zabelina et al., 2019) or general intelligence (Karwowski et al., 2020). Cognitive processing was examined through a measure of associative abilities operationalized as the number of generated responses and their semantic distance (He et al., 2020), "forward flow," the degree of semantic change within words produced in a stream of thought (Gray et al., 2019), or idea linking, "a cognitive process that entails using aspects of early ideas as input for subsequent ideas in a sequential manner, such that one idea is a steppingstone to the next" (Hagtvedt et al., 2019, p. 1), as well as response fluency and mental speed (Dygert & Jarosz, 2020; Forthmann et al., 2020). Finally, language abilities examined included comprehension abilities (Wu & Chen, 2019), semantic memory (He et al., 2020), and vocabulary (Menashe et al., 2020).

Pathos: Cognitive and Emotional States

Only a handful of studies examined the impact of cognitive and emotional states. Most of these (n = 6) focussed on cognitive states such as self-control states manipulated through ego depletion (Bertrams & Englert, 2019; Taylor, 2021), relaxed or mindful states, manipulated through a yoga session (Bollimbala et al., 2020) or a massage session (Meier et al., 2020), or the elicitation of a state of "specific curiosity," manipulated by leaving participants curious about how a magic illusion was accomplished (Hagtvedt et al., 2019). For example, in Study 1, Hagtvedt et al. developed a "magic trick vignette" that was either intended to induce curiosity about how an illusion was accomplished (experimental condition) or provided a description of how the illusion worked (control condition). All participants were then asked to think of a new magic trick themselves, which were then evaluated by professional magicians. The ideas generated by the participants in the curiosity condition were nearly twice as likely to be judged as creative by the magicians, suggesting that experiencing a state of curiosity can boost creative performance.

Only one study examined the impact of an emotional state, namely creative anxiety, experimentally induced through announcing an imminent performative test, although they found strong support for the null hypothesis suggesting that creative flexibility performance was not related to state anxiety (Bertrams & Englert, 2019). In addition to cognitive and emotional states, one study also examined the role of a motivational state, namely "activation," defined as the degree to which one feels mobilized or energized and measured through self-reports (Kapadia & Melwani, 2021). For example, when participants were involved in a multi-tasking simulation (receiving and dealing with conference calls and emails at the same time rather than in sequence), they experienced more activation and, in turn, produced more creative ideas in a follow-up task, as rated by three independent coders who were blind to the experimental conditions (Kapadia & Melwani, 2021, Experiment 3). Besides activation, an additional two studies examined the role of non-habitual or altered states of consciousness, namely dreaming, either by measuring dream intensity (Yu, 2020) or enhancing dream recall through daily logging (Sierra-Siegert et al., 2019).

Ethos: Attitudes, Values, and Motives

We could only identify one study under this heading, which examined the impact of a growth theory of interest (i.e., believing that interests are not fixed and can be developed) on creative cognition (O'Keefe et al., 2021).

Praxis: Actions, Habits, and Behaviours

This last category was added to account for the studies examining actions or habits that promoted participants' creative performance. The factors examined included physical behaviours that were initiated by participants through deliberate practice, such as behaviours involved in professional music or professional sport practice, and their impact on creativity (Hüttermann et al., 2019, Palmiero et al., 2020), or the impact of spontaneous physical activity (e.g., a dance session, Bollimbala et al., 2020). The remaining studies in this category focussed on cognitive behaviour by examining self-initiated rather than experimentally manipulated information-processing behaviour. For example, one study explored the impact of self-reported justifications for decisions taken in a creative task and suggested that idea generation is supported by predictive and evaluative cognitive strategies (Valtulina & de Rooij, 2019). Another study examined the impact of the time spent searching for information and the quantity and breadth of the information retrieved on creative solutions to a problem (Harms et al., 2020). More broadly, individual differences in thinking time were identified as a predictor of originality in verbal and figural responses to a divergent thinking task (Acar et al., 2019). Self-initiated task-switching and multi-tasking were another type of cognitive behaviour found to be predictive of creative performance when the switch is made on a congruent intervening task (Kapadia & Melwani, 2021; Madjar et al., 2019) or during a mind-wandering episode (Gable et al., 2019).

Synthesis of Current Trends in Human Experimental Research on Creativity

Current studies of creative performance could be mapped against the previously identified five contributing elements (Sakellariou et al., 2020): Topos (contextual and environmental influences), Demos (demographic characteristics), Logos (pre-existing abilities or personality traits), Pathos (cognitive and emotional states), and Ethos (attitudes, values, and motives), as well as an additional element, Praxis (actions, habits, and experience).

Most commonly, recent studies investigated Logos and Topos influences, suggesting two conceptions of creative cognition within the field. On the one hand, the many studies examining cognitive abilities (e.g., associative abilities, cognitive flexibility, or attentional control abilities) suggest that creative cognition is perceived as an inherent ability that may exist in some individuals more than others, depending on their cognitive wiring. On the other hand, several studies examined transient influences on creative cognition such as external sensory or attentional primes (e.g., visual priming or attentional focus) or internal states of consciousness (e.g., dreaming, relaxed, or curious). We found the studies examining Praxis influences particularly interesting and noteworthy, as they may form a promising point of entry to reconcile insights about creative cognition in user innovation studies with those in human experimental psychology. Indeed, by focussing on the role of practice and habitual behaviour, these studies also point to an alternative conception of creative cognition, one that is emergent from the micro-decisions that individuals take as they engage in the creative task and that is both informed by the historicity of past behaviours and the affordances of the context in which they are embedded.

This is reminiscent of the distributed perspective on cognition, which posits that cognitive behaviours neither solely result from pre-existing mental abilities or traits nor from congenial but static environments, but instead from the transactions between abilities and

environmental affordances in a dynamic, ever-changing perceptual field (Hollan et al., 2000; Hutchins, 1995; Kirsh, 2006; Sutton, 2006; Vallée-Tourangeau et al., 2015; Vallée-Tourangeau & Vallée-Tourangeau, 2017).

The challenge for future research on creative cognition therefore becomes both epistemological and methodological. From an epistemological standpoint, the field needs to overcome the limiting dichotomy of conceiving creative cognition as either something that comes from one's "mental assets" (Logos) or subtle "environmental prompts" ("Topos") and instead better understand how individual and environmental characteristics may complement (or not) the cognitive and behavioural paths to creative cognition. From a methodological standpoint, of course, this transactional approach calls for rethinking what process-tracing methods may be used to follow creators and their activities to uncover how creative outcomes emerge from this creativity triad: individual characteristics, environmental affordances, and behaviours *in practice*. Observational process-tracing studies can be time-consuming and technically challenging, but video-based ethnography is a promising path to overcome this challenge, which could be complemented by artificial intelligence and machine-learning analysis of behaviour.

Concluding Thoughts

This scoping review aimed to provide a comparative mapping of studies in innovation management and in human experimental psychology against pre-existing higher-order categories of creative behaviour antecedents: topos (physical/virtual space), demos (demographic characteristics), logos (pre-existing abilities and personality traits), pathos (emotions), and ethos (values and motives; Sakellariou et al., 2020); it also identified a sixth dimension, praxis (actions, habits, and behaviours). The mappings in these separate areas of literature focussing on creative cognition led to several scholarly insights.

Both streams of literature examined individual differences, but from a different angle: many studies focussed on the role of individual cognitive abilities in experimental psychology studies, while this aspect has not been recently explored within the user innovation literature; conversely, the influence of individual demographics has received much more attention in the user innovation literature than in the experimental psychology literature. Notably, individual creativity in user innovation research was characterized as a self-initiated, deliberate, and independent endeavour: users are not asked to innovate; the object of study is innovation as a naturally occurring process. This is in sharp contrast with the experimental laboratory contexts where creative activities are initiated and led by the experimenters rather than the participants. In experimental studies of creative cognition, an implicit assumption appears to be that creativity can happen "on demand," while studies of ordinary users show that the biggest drive for individual creativity may be, on the contrary, an individual's need to find a solution to a problem they personally care about or find exciting. Feeling boredom or dullness towards tasks was a barrier to user innovation and could arguably also impact creative performance in experimental studies.

Another apparent contrast relates to the space within which creative behaviour takes place. User innovation studies highlight the importance of a safe, intimate, and familiar context to foster creative solutions. In contrast, experimental psychology studies of creative cognition pay little attention to the "cosiness" of the environment within which individuals are asked to engage in creative cognition. In fact, it is not always clear where participants are asked to be creative, whether in a laboratory room, on their own, or alongside unknown peers. And, in any case, none of these situations would compare to the familiar and safe contexts for

creativity highlighted in user innovation research. While experimental studies neglect the impact of "topos" (presumably because it is tacitly conceived as a confounding variable that needs to be controlled), user innovation studies are exploring new spaces where innovation may happen, such as 3D virtual environments. This could provide a fruitful, promising, and exciting avenue for future research in both fields, as virtual reality will allow for the experimental manipulation of environmental features and the assessment of their impact on creative behaviour. Moreover, this will also allow to explore and measure the impact of virtual interactions on creative performance, as some user innovation studies have started to explore (Yang et al., 2020). Conversely, human experimental studies focussed on potential contributing factors that could well spur new research in the user innovation field, such as the role of peripheral and transient influences that are not related to the task at hand (e.g., visual priming or attentional focus), which could also be explored in actual or virtual environments. Studying the role of "mental safety" (e.g., through the manipulation of cognitive states) as opposed to, or in addition to, "environmental safety" may also shed new light on user innovation.

To conclude, this review suggests that user innovation and creative solutions emerge when an individual has a recurrent problem that they feel connected to and compelled to solve while being in a safe place to explore and experiment. In our quest to understand creative cognition, we must not lose sight of the untapped creativity potential in the general population. Future interdisciplinary research could combine efforts to understand the basic cognitive processes at play in creative cognition with an understanding of its individual-led motivational and environmental drivers *in situ* or in laboratory environments designed to boost creative potential. Arguably, what managers and policymakers will need most in the years to come is to understand what needs to be done to unlock employees and citizens' creative potential and how to empower them to innovate.

Note

1 The concepts of creativity and innovation are essential parts of the same process and for this reason in this section they will be used interchangeably.

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