Extraordinary LED installations: Events for user-innovation interaction

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Abstract: Recent innovation research describes events as mechanism for innovation diffusion but does not explore their socio-material dimension. This study compares and conceptualizes event settings that allow professional technology users to engage with an innovation before they adopt it. The focus is on temporary installations of light-emitting diodes (LEDs) in lighting trade fairs and light festivals. LEDs are currently transforming the lighting field. This study focuses on the time when LED products were already on the market but demand was still low. Based on ethnographic research, it shows that in this critical situation, events offered professional users formats for trying and evaluating LED technology in event-specific ways. While trade fair displays promoted the adoption of LED products, festival projects allowed professional LED users to creatively adapt and shape the new technology. Theoretically, this study combines social-scientific innovation research on events with social-constructivist studies on user-innovation interaction in a multi-level conceptual framework.

Keywords: Innovation users, field-configuring events, trade fairs, festivals, LED lighting

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1. Introduction

Users matter—this fact is well established in innovation research (Oudshoorn and Pinch 2003). Their positive evaluation and adoption makes the difference between an invention and an innovation (Fagerberg, Mowery, and Nelson 2005, Braun-Thürmann 2005). Early adopters spark diffusion processes as they lead by example and are imitated by their peers (Rogers 1995). Professional "lead users" also actively contribute to product development and adapt innovation (von Hippel 1986, Grabher, Ibert, and Flohr 2008, Hienerth, Pötz, and Von Hippel 2007, Hyssalo, Jensen, and Oudshoorn 2016). Yet surprisingly, the *actual situations* in which users encounter innovation in the first place and first time have received very little scholarly attention. "The new must be brought into the familiar world and enter into exchange with prior experiences," writes Nowotny (2008, 2). In fact, such first encounters already occur *before* the new has entered the familiar world, namely during events where innovation is temporarily presented or used in *extraordinary settings*.

Recent innovation research suggests that organized events can function as "mechanisms of innovation diffusion" and help firms "to generate and disseminate new product innovations" (Schüßler, Grabher, and Müller-Seitz 2015, 168). It shows that trade fairs, conferences and festivals facilitate information flows and the valuation of novelties (Moeran and Pedersen 2011, Maskell, Bathelt, and Malmberg 2004), shape new technologies and meaning (Garud 2008, Zilber 2011) and allow exhibitors to present their new products and ideas "in a manner likely to elicit their [audiences'] interest, approval, and ultimately, their support" (Lampel 2001, 303). These studies underline the relevance of spatial settings and imply that event participants interact with new products in extraordinary event situations. Yet, theoretical explanations for how socio-material settings contribute to innovation diffusion are rather unconnected or entirely unexplored. Thus, it is an open question whether trade exhibitions engage potential innovation users in the same way as festival scenes or conference settings.

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This ethnographic study explores the socio-material dimension of events by linking existing concepts in a multi-level analytical framework and by testing them in an original comparative research design. With a focus on *event formats for user-innovation interactions*, I compare installations of *the same technological innovation in the same diffusion stage, but in most dissimilar event settings*. The theoretical question is: How can we understand the socio-material dimension of user-innovation interaction during events with regard to innovation diffusion? Empirically, I ask how different event series allow technology users to engage with innovation before they adopt it. Potential effects on innovation diffusion are discussed theoretically. The thesis is that socio-material formats contribute to market creation and technology shaping by allowing *event-specific* user-innovation interactions.

The technological innovation in question is solid-state lighting, better known as light-emitting diodes (LEDs). Innovators consider these tiny semi-conductor chips as the 21st century's digital "revolution" in lighting and predict that LEDs will replace all conventional light sources in the near future (Haitz 2003). Indeed, energy-efficient LED solutions are increasingly used in public streets or buildings for general lighting. This paper discribes an earlier moment only a few years ago, when LED installations were still rare in the real world but already excessively presented and used during lighting trade fairs and festivals of light. These very dissimilar event types are perfectly suited for this comparative study as they also attract the same *professional users* of lighting technology, particularly light planners and lighting designers.

The focus on professional users is not only methodologically motivated but also theoretically relevant. In the innovation process, lighting professionals act as intermediaries between light manufacturers and 'end users' of LED light and thus play a potentially important role as expert users and co-developers of new lighting solutions (cf. Hyssalo, Jensen, and Oudshoorn 2016, Grabher, Ibert, and Flohr 2008).

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To systematically analyze what events can offer professional users, I draw on three strands of social-scientific innovation research. Firstly, economic geographers have shown that trade fairs help create markets and value chains by facilitating learning and information flows in a cluster-like manner, also in the lighting industry (Bathelt and Schuldt 2010, Schuldt and Bathelt 2010, Power and Jansson 2008). Secondly, management and organization studies focus on valuation processes and sense-making in innovation contexts, using the concept of "field-configuring events" (FCEs) to describe institutional and transformative event effects in organizational fields (Lampel and Meyer 2008, 1026, Schüßler, Grabher, and Müller-Seitz 2015). Thirdly, studies on science, technology and society (STS) close the above-mentioned theoretical gap regarding the socio-material dimension of user-innovation interactions. They show that technology users do not just adopt, but *adapt* innovations in "scripted" or "configured" situations (Oudshoorn and Pinch 2003, Akrich, Callon, and Latour 2006).

The article is structured as follows: In the next section, I outline the three social-scientific perspectives that form my conceptual framework. Section 3 describes how the "LED revolution" transforms the "world of lighting" and what difference users can make in the process. In section 4, I outline my grounded methodological approach and research design. In part 5, I present two case studies on the trade fairs Light + Building (Frankfurt/Main) and LumiVille (Lyon) and two case studies on the light festivals Fête des Lumières (Lyon) and Luminale (Frankfurt/Main). In part 6, I discuss their socio-material formats for user-innovation interaction in relation to the innovation process in the lighting field. To conclude, I summarize my findings and outline some implications and questions for further research.

2. Conceptualizing event formats for user-innovation interaction

In recent years, periodically organized *event series* have received increasing attention in social-scientific research on creative and innovating industries (Schüßler, Rüling, and Wittneben 2014, 141, Schüßler and Sydow 2015). This research links extraordinary micro-

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level interactions to macro-level innovation dynamics. In particular, economic and geographic research conceptualizes event series in relation to the creation of value chains and markets in global industries. Management and organization studies analyze the effects of extraordinary event situations on organizational fields and their "recognized area of institutional life" (DiMaggio and Powell 1983, 148). Both perspectives also see beyond the singular event and describe event series as part of larger event landscapes in innovating fields or industries.

What they do not offer is an explicit focus on innovation users in socio-material event settings. In this respect, studies on science, technology and society (STS) on innovation users, technology trials and adoption events offer salient concepts for analyzing formats for user-innovation interaction. This section outlines how the three perspectives conceptualize event formats and assembles their complementary concepts in a multi-level theoretical framework.

Events as "novelty-bundling", buzzing "clusters" in economic and geographical research

Economic geographers describe events as geographies of "temporary spatial proximity" with cluster-like effects (Lange, Power, and Suwala 2014, 194). They show that trade fairs periodically bridge spatial distances and thus constitute "temporary clusters" in globalized industries, including the lighting industry (Bathelt and Schuldt 2010, Maskell, Bathelt, and Malmberg 2004). As such, they help create value chains and mediate between the local and global scale of personal and inter-firm relationships. While Bathelt, Schuldt, and Maskell (ibid) stress the dynamics between local and global level, Power and Jansson (2008) highlight the periodical production of related event spaces. "Cyclical clusters" connect industrial sectors in a "global circuit" of events facilitating the exchange of market information.

Not surprisingly, geographers also have an eye for spatial and socio-material event settings. Power and Jansson describe the "sensory overload" inside the exhibition halls of furniture trade fairs arguing that this opportunity "to touch and feel products" is "likely to be highly related to [visitors'] initial motivations for being there" (2008, 429). Similarly, Bathelt and

Schuldt refer to the "global buzz" of trade fairs (2010), which includes not only face-to-face but also user-product interactions. In their study on the 2004 Light + Building trade fair, they quote a company executive as follows: "You can get all the information about new developments. You can see it, hear it—you can see the materials and the effects they have on people. It's something you cannot get from a catalogue" (2005, 19, my translation). Yet, despite their apparent relevance, the effects of socio-material formats for user-innovation interaction are not further conceptualized.

In this respect, the notion of events as "novelty-bundling markets" offers an interesting point of departure. From an evolutionary economics perspective, Potts (2011) proposes the concept for capturing the positive demand-side effects of events in the creative industries. His point is that "novelty bundling" during cultural festivals and art exhibitions makes it easy for potential users to compare and appreciate new products and ideas. In the face of "abundant novelty", the selection and curated display of new products or ideas reduce the costs of selection and evaluation on the demand side. Yet, while Potts underlines the crucial role of curators and presenters who bundle novelties in enjoyable and attractive formats, he does not further specify how formats for novelty-bundling work.

In sum, economic and geographical research shows that "novelty bundling", "sensory overload" and "global buzz" are characteristic features of innovation-oriented art and trade exhibitions and help potential users to discover, try, evaluate, and select innovation. It is suggested that socio-material event settings matter and positively affect the adoption of innovation, but they are not systematically compared and analyzed.

Organized "field-configuring events" in organization and management studies

The relatively young concept of "field-configuring events" (FCE) focuses on the effects of temporary and spatially bounded live interactions on organizational fields (Meyer, Gaba, and Colwell 2005, Lampel and Meyer 2008, Schüßler, Grabher, and Müller-Seitz 2015). The

concept is enjoying increasing attention in organization and management studies and particularly in research on the creative industries and other innovating fields.

Case studies on field-configuring events cover a wide range of event series and event types, including award ceremonies, international conference series (Schüßler, Rüling, and Wittneben 2014), trade fairs, and artistic festivals (Moeran and Pedersen 2011, Rüling 2011). Events are broadly defined as temporally and spatially bounded, socio-materially structured, and functionally unbounded (Moeran and Pedersen 2011, 6-7). They are therefore unpredictable in their outcomes and extraordinary when compared to routine interactions between the individuals and organizations in a field. According to Lampel and Meyer, events "protect individual initiative and creativity from the relentless isomorphic pressures of institutional field logics". Similar to Potts, they further suggest that events facilitate the selection of "those novel products, ideas, or actions that come to be valued within the field" (2008, 1028-29). This claim has been further explored in empirical studies that show that events promote the recognition, categorization and valuation of novelty through shared experiences or simultaneous sense-making (Anand and Jones 2008, Moeran 2011, Lampel 2011). They also create live situations that are distinct from the usual institutional settings and offer time spaces for raising, negotiating and resolving issues (McInerney 2008, Dobusch and Schüßler 2010, Hardy and Maguire 2010).

In this context, socio-material event settings can facilitate interactions that have not yet been institutionalized. For instance, Garud (2008, 1069) argues that exhibitions can have a "narrative" persuasive power. In contrast to "logico-scientific" conference discourses, technology displays "attempt to convince by endowing experience with meaning through 'verisimilitude'…" (2008, 1066). Lampel (2001, 314) contends that product demonstrations can support ongoing innovation processes as they can "direct the audience's attention away from the imperfections of the specific technology" and towards future benefits—critical evaluation gives way to commitment.

On the other hand, socio-material event settings can also relativize field-configuring effects. As Zilber shows the socio-material designs and communication "genres" of a high-tech event reproduced the inequalities and power structures of the industry (2011, 1552). Moeran (2011) points out that trade fair organizers and exhibitors control "visibility" by investing large sums in the architectural designs of their exhibition booths, or by allocating presentation spaces and providing information about the event locales in the form of maps, signage or programs (cf. Power and Jansson 2008). Obviously, the resources and opportunities to shape event settings in that way are not equally distributed.

Power struggles are also implicit in the notion of "field mandates" (Lampel and Meyer 2008, 1028), that suggest that events might have a stronger or weaker impact on their field. Schüßler, Rüling, and Wittneben (2014) describe similar performative effects within the same event series. Two subsequent international climate conferences had very different consequences because organizers and participants staged one event as "low-stake" and the next as "high-stake".

To conclude, the concept of field-configuring events seems particularly well-suited to analyzing event formats for user-product interactions in their multiple embedding contexts. Through the field-theoretical analytical lens, socio-material event formats can be understood as both *field-shaping* and *shaped by* their field and its "complex event ecologies" (Schüßler, Dobusch, and Wessel 2014, Schüßler, Rüling, and Wittneben 2014). This sensitivity for field-level power relations and dynamics, which is at the heart of field-theoretical approaches (Martin 2003), adds an important analytical dimension. Nevertheless, it takes a third lens to understand how situated interaction can reproduce or undermine field-level power structures.

Socio-material adaptations of innovations in studies on science, technology and society

Studies on science, technology and society (STS) offer a heuristic that underlines the relevance of local-scale socio-material interactions in the context of large-scale innovation

processes. User-innovation interactions are a central topic. They are analyzed in ethnographic detail in different stages of innovation processes, including user trials, technology tests, and product presentation (Oudshoorn and Pinch 2003, Simakova 2010, Woolgar 1991).

From this close-up perspective, the innovation process does not end with the adoption of new products. Instead, producers' and users' experiences, evaluations and routines become manifest in product designs, presentation formats and modes of interaction. STS studies show that technological innovations are "interpretatively flexible" and remain so throughout the diffusion stage (Bijker 1992). "To adopt is to adapt" is a key message of the so-called Sociology of Translation, which describes innovation and diffusion as a seamless process of forming and stabilizing new relationships with and around new artifacts (Callon 1986, Akrich, Callon, and Latour 2006). In this process, "translations" occur when repeated interactions lead to social and material adaptations that transform user-technology relationships, bodies, forms and familiar worlds irreversibly.

STS studies also pay close attention to the various socio-material settings and sites of innovation, including laboratories, test fields, and public experiments or demonstrations. As Pinch demonstrates, demand for new technologies and products can emerge in the course of live events and be shaped in public sales demonstrations (2003, 1993). Similarly, Simakova describes product launches as "theaters of proof" where participants "talk new technologies into existence" (2010, 568). Vice versa, users are "configured" through socio-material formats that predefine or prescribe certain ways of using new technologies (Woolgar 1991). Such socio-material configurations or "scripts" have a reality-shaping power that can promote or hamper the adoption of new technologies. Yet, users do not always follow the "scripts", but also actively "descript" technological artifacts while using them in their own ways (Akrich and Latour 1992). They also reconfigure interaction formats with innovation-shaping effects (Hyssalo, Jensen, and Oudshoorn 2016, Suchman 1987, Oudshoorn and Pinch 2003, De Laet and Mol 2000).

To conclude, constructivist studies underline that innovation displays, tests and installations are socio-materially configured. Festival and trade fair formats can thus be understood as socio-material settings that configure user-innovation interactions but always leave space for "description" and reinterpretation. STS studies further acknowledge that innovations are reinterpreted and materially adapted in the course of their diffusion. Innovation diffusion is reconceptualized as a process of mutual socio-material translations, in the course of which innovation users form new relationships with new artifacts and are themselves transformed in the process of network formation.

Summing up, the described concepts offer a large toolkit to conceptualize the socio-material dimension of events with regard to innovation diffusion in terms of continued technology-shaping (adaptation) and market creation (adoption). Table 1 illustrates how the complementary theoretical lenses add up to a conceptual framework.

Insert table 1 around here

On the micro-level, STS studies provide concepts for capturing the socio-material dimension of user-innovation interactions. On the meso-level of "event ecologies" (Schüßler, Dobusch, and Wessel 2014) and "cyclical clusters" (Power and Jansson 2008), we can expect performative effects and field pressures. On the macro-level, the conceptualization of innovation diffusion varies depending on the research perspective. Through the economic and geographical lens the LED revolution raises the question of how local event interactions can contribute to market creation and new business relations that might include professional users. If we consider the LED "revolution in lighting" as a field crisis (Fligstein 2001) that calls into question a "recognized area of institutional life" (DiMaggio and Powell 1983, 148), event interactions might help to reconfigure or maintain the lighting field by redefining or stabilizing existing uses. Through the micro-analytical social-constructivist lens, event settings can be understood as sites where innovations enter in exchange with the familiar world and might "translate" it irreversibly.

3. The "LED revolution" in the European "world of lighting"

The research presented in this paper was conducted at a critical moment of the LED innovation process. Before 2012 LED products had already entered the market for general lighting but were not yet widely adopted and still being improved and adapted. This section outlines how the technological "revolution" (Haitz 2003) has shaken Europe's "small world of lighting", as an interview partner called it.

The first LED products for indoor and outdoor lighting appeared on the market around 2005.[1] Since then, the technological development has been rapid, and demand has become a critical issue. The advent of LEDs has led to a globalization of value chains and an acceleration of business cycles (Schulte-Römer 2013b). The routine replacement of standardized light sources on which the 20th century lamp industry was founded is rendered obsolete by LEDs, which last much longer than incandescent bulbs or gas-discharge lamps. Traditional European lamp and luminaire manufacturers complain about market failure and have been facing a sink-or-swim challenge. Furthermore, they are challenged by new players, particularly Asian companies with expertise in semiconductors and electronics.

On the demand side, the tiny and digital semiconductor chips have multiplied the options for light planning and lighting design. LEDs are extremely energy-efficient and have a longer life span than most conventional products, which can reduce both energy and maintenance costs. They can be dimmed and digitally programmed. Their color temperature can be tuned from cold-white to warm-white light and their light distribution can be customized. However, new demands and uses of artificial lighting have been changing rather slowly.

[1] The first red-glowing diode was invented in 1962 by Nick Holonyak and his team at General Electrics (Manchester 1963). Since then, the tiny crystalline semiconductor chips have diversified in colors and become much more efficient in light output. In 1994, three Japanese scientists, Isamu Akasaki, Hiroshi Amano and Shuji Nakamura, invented the first bright blue LEDs, for which they were awarded with the 2014 Nobel Prize in Physics. The high-efficient blue LEDs were the long-sought-for missing piece in the development of white LED lighting for general lighting purposes, as envisioned since the 1960s (Johnstone 2007).

Accordingly, LED technology is developing into two directions, one more radical than the other. On one side, light manufacturers produce *LED retrofit solutions* that look like light bulbs and are familiar in form and use. LED retrofit products have the advantage of meeting *conventional demands of mainstream users in energy-efficient ways*. But they also compete with much cheaper conventional light sources. On the more radical side, manufacturers are exploring new designs and digitally integrated lighting systems for "smart homes" or "smart cities". So-called s*mart solutions* and "intelligent" lighting systems fully exploit the flexibility, energy-efficiency, and digital connectivity of LEDs. But they also imply *new uses* of lighting technology and challenge professional users to develop new lighting solutions. While *conventional light* planning focuses on light levels and light distributions for specific spaces, *smart solutions* add a temporal dimension by proposing interactive, customized light uses for specific night-times.

When this research was conducted the advantages of LED lighting were all but obvious. Smart uses had as yet to be invented and the technology was still immature. Numerous uncertainties diminished the positive appeal of the innovation. The performance characteristics of LED retrofit solutions (light distribution, color rendering, light output) were barely comparable to conventional light sources, making informed product choices difficult.[2] In the absence of LED product and performance standards, a lot of trust had been forfeited. LED producers, particularly new market entrants with little expertise in lighting, offered premature and poor-quality products, including flickering lights with unpleasant color temperatures. Moreover, the innovators' promises were often hard to verify since LED

[2] Problems include flicker and color degradation. Moreover, existing photometric measuring methods cannot fully capture the qualities of LED products. For instance, conventional ways of describing light color in wave lengths and Kelvin have become problematic since LED colors cannot be precisely located on the black-body curve in the three-dimensional CIE 1931 color space. A new standard by the American National Standards Institute (ANSI C78.377-2015) guarantees LED color quality based on MacAdams ellipses (e.g. 2700 ANSI Kelvin for warm white).

technology was not yet in use. As a result, professional users complained about bad product quality, a lack of reliable standards and product information, and remained hesitant to adopt LED technology. At the same time, they played an important role as intermediaries between the rapidly developing LED technology and the slowly evolving demand of lay 'end users' of artificial light. During events, they could be observed as they tried and evaluated LED products.

Since the "LED revolution" has been declared, events have been mushrooming in different corners of the European "world of lighting". The creation of new light-related event series reflects the increased demand for information and coordination. Innovators meet all over the world to develop and discuss roadmaps, standards, alliances, and to share their views and visions. Professional users visit trade fairs and present projects during light festivals. The fact that the same technology, the same actors and organizations participate in light festivals and lighting trade fairs underlines my claim that all four event series are part of the same field. The following section offers more insights into the new landscape of light events.

4. A grounded multi-sited and comparative approach

The research question of this paper emerged from a larger project on the ongoing LED innovation process in the lighting field (Schulte-Römer 2015). Attending light-related events was a cornerstone of my grounded, multi-sited ethnographic approach (Marcus 1995, Clarke 2005). After all, conferences, festivals and trade fairs do not only help innovators and users but also researchers to keep track of worldwide innovation activities and provide "fertile settings for collecting rich data" (Lampel and Meyer 2008, 1026). During trade exhibitions, I visited LED manufacturers' booths, studied their product displays and talked with innovators and visitors about the latest trends, bad-quality products, or unreliable information. During the festivals, I experienced artistic LED installations and observed their presenters and audiences.

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This section first gives an overview of my case selection. It situates my cases in the event landscape of the lighting field and describes my research design, data collection and analysis.

Research setting and case selection

In recent years, event series have mushroomed in the lighting field (see table 2). To understand if and how their different extraordinary LED installations could possibly affect professional users' innovation experiences I focused on lighting trade fairs and festivals as the most obvious and also "most dissimilar cases" (Glaser, Strauss, and Strutzel 1968). The theoretical assumption was that their formats for user-innovation interaction would vary in the greatest possible way, but still be part of the same "event ecology" (Roche 2000, 3) and attract the same professional user groups.

Festivals and trade fairs occupy the most distant corners in the innovating lighting field, but still assemble the same usual suspects of the "small world of lighting". Whereas trade fairs are close to the lighting market and industry and hence *at the center* of the innovating field, light festivals take place *at the fringes* close to the creative industries and urban development. Both event types involve LED installations but for very different purposes. While trade fair displays promote products, festival installations are means to create novel experiences for wider audiences in urban public spaces. Contrasting these most dissimilar event types allowed me to explore the scope of event-specific formats for user-innovation interactions. In this section, I first situate my cases in their wider event landscape and then explain my case selection in more detail.

[insert table 2 about here]

The first events in the lighting field with a clear focus on the LED innovation emerged around 2000 (see table 2). LED-related event series range from business-oriented conferences and trade fairs ("events upstream") to artistic performance-oriented light festivals ("events downstream"). Specialized media and marketing corporations launched new conference series

like Forum LED or Strategies in Light (top tree events). LEDs have also become a key theme at light engineering conferences like LUX Europa and industrial trade fairs, including Light + Building (middle). In the past decade, the institutionalization of the lighting design profession and the invention of "nocturnal urbanism" have generated additional specialized events, including the PLD-C lighting design conventions and the LUCI urban lighting conferences (middle to bottom). In this context, light festivals are increasingly popular as part of urban regeneration strategies. Although LED lighting is not the focus of these events, they still make use of it and also involve LED manufacturers as sponsors, presenters or visitors.

Given this wide spectrum of LED-related events, my aim was to contrast different event types—in addition to comparing single events of the same type—in order to comparatively explore how they facilitated user-innovation interactions. From the numerous events that I attended between 2008 and 2013 (table 3), I chose two trade fairs and two festivals in the same two cities: the trade fairs Light + Building in Frankfurt (L+B) and LumiVille in Lyon, and the festivals Fête des Lumières in Lyon and Luminale in Frankfurt.

[insert table 3 about here]

The case selection was based on theoretical sampling strategies and constant comparison (Clarke 2005). Firstly, I chose from each event type the one that appeared to have the strongest "field mandate". *L+B in Frankfurt* offered an obvious starting point (notes 2010-04; 2012-04).[3] It is considered the world's leading trade fair for lighting and can be viewed as an event that defines which market sectors, organizations and products fall within the scope of the lighting field. Where, if not here, would I be able to study formats for user-innovation interaction "in a nutshell" (Garud 2008, 1084)? Analogously, *the Lyon Fête des Lumières* is a key reference when it comes to light festivals (notes 2010-12; 2011-12). Lyon, the French "City of Light", is internationally renowned for its expertise in urban lighting and also hosts LumiVille, a trade fair for urban lighting.

[3] The references (notes year-month) refer to field notes as listed in table 3.

The selection of LumiVille and Luminale followed theoretical and practical considerations. Most importantly, the events were also based in Lyon and Frankfurt. Focusing on events in the same two cities made it easier to consider their embedding urban contexts. *The Luminale festival* in and around Frankfurt is a side event of L+B, but has developed a life of its own (notes 2010-04; 2012-04). Like the Lyon festival, Luminale attracts lighting professionals from all over the world who visit the festival when the doors of L+B close in the evening. *The Lyon trade fair LumiVille* qualified as a suitable contrast to L+B as it can be considered a typical smaller trade fair with a lighting focus (notes 2010-06). In size, structure and atmosphere it shows similarities with other smaller exhibitions, including the Belektro trade fair in Berlin (notes 2010-10) and product exhibitions during the Professional Lighting Design Convention series (notes 2009-10; 2011-10; 2013-10), ForumLED (notes 2011-12) and Strategies in Light (2012-09). In contrast to the Frankfurt cases, the Lyon events are not linked and do not take place simultaneously. The traditional date for Fête des Lumières is December 8, while LumiVille takes place in late spring. Nevertheless, the trade fair profits from Lyon's good reputation as a "City of Light" and its world-famous annual festival.[4]

Last but not least, the event timing was crucial for the case selection. In the face of the rapid LED development and dynamics in the lighting field it was important to select events that more or less reflect the same moment of the innovation process. While my research period covers events between 2009 and 2014, the trade fairs and festivals analyzed in this study took place in the course of less than two years, from L+B 2010 to Fête des Lumières 2011.

Data collection and comparative analysis

My focus and unit of analysis were *formats for user-product interactions*, i.e. actual LED installations during events. Their identification and analysis involved more methodological decisions. For ethnographic data collection, events present the challenge of having to choose

[4] Other Lyon-based lighting events profit even more from the festival. In 2009, the LumiVille organizers founded the international conference ForumLED, which ran parallel to Fête des Lumières before it moved to Paris.

between various simultaneous live activities that could all be meaningful or develop spontaneously in meaningful ways. Making a virtue out of necessity, I pursued a twofold strategy. *In interviews* with manufacturers and curators, I focused on the event organizers' perspective. *As a participant observer*, I randomly followed the event visitors who often voted with their feet, indicating which exhibition booths or festival installations were most visible (cf. Schulte-Römer 2013a). During L+B, guided tours for professional users of lighting technology, including municipal light planners and architects, helped me to objectify my personal experience and research choices. As they were guided by lighting designers, they also revealed how early LED users made sense of the event, the innovation and the new products on display.

In line with my grounded approach (Clarke 2005), the data collection and analysis took place simultaneously based on the principle of "constant comparison". Observations and conversations were documented in the form of memos during or immediately after the events. The collected data included photographs and short video sequences, semi-structured interviews with organizers, presenters, and attendees, as well as press kits and event reports.

As outlined above, events are characterized by their particular *temporal* and *spatial* structure and extraordinary live *interactions*. The same three dimensions guided the coding of the heterogeneous data and my search for event-specific formats for user-product interaction. Accordingly, I compared the socio-material settings of user-LED interactions with regard to their duration, spatial structure and the modes of interaction they facilitated. Doing so, I identified three *format categories* as outlined below. Furthermore, I explored and tested the scope and event-specificity of the formats via constant comparison both on the level of most dissimilar event types (festival or trade fair) and most dissimilar trade fair or festival series (L+B vs. LumiVille and Luminale vs. Fête des Lumières, see table 4).

[Insert table 4 about here]

5. Observations and empirical findings

The observations and findings of my study are presented in four sections and three analytical steps. Firstly, I focus on LED displays during L+B 2010. Second, I compare L+B and LumiVille and show that trade fairs can differ considerably with regard to providing such formats for user-innovation interaction. Thirdly, I turn to Luminale and Fête des Lumières and describe two festival projects and their specific settings for user-LED interactions. As we will see, festival formats differ entirely from trade fair settings. Furthermore, the four cases also addressed different innovation-related challenges in event-specific ways.

Product displays at Light + Building: Formats for experiencing the new light

Light + Building came to Frankfurt in 2000 when the Hannover industrial fair outsourced the growing lighting segment. The first L+B attracted 100,000 visitors and 1,800 exhibitors—a "sensational success" (PLD-Magazine). Today, the biennial event is considered the world's leading trade fair for lighting and architecture. According to interview partners, visits to Frankfurt are a must for anyone who is involved in lighting. The trade fair organizers relate the fair's importance to its success in attracting visitors from both the lighting field and the adjacent building and design sector (Messe Frankfurt 2013).

The size of L+B is overwhelming, too big to grasp. In 2010 the exhibition space consisted of multi-story halls extending across the fairground connected via gangways and shuttle buses, covering over 247,100 m^2. The spatial arrangement of the exhibition represented different sectors of the lighting market, with halls for technical luminaires, decorative lighting, automation systems, and electro-technical components. LED solutions for indoor and outdoor lighting were presented in the most prominent halls near the entrance. LED product displays varied in terms of their design and sophistication.

LED technology attracted considerable attention during L+B 2010. For the first time, almost all manufacturers exhibited LED products and the event was dubbed "LED + Building".

Visitor reports suggest that L+B 2010 successfully demonstrated that LED technology was ready to use. After the event, municipal light planners reported that they had chosen their first LED street luminaires in Frankfurt. A high-ranking German policymaker who was then in charge of the German "LED lead market initiative" concluded that "LED technology is now mature" since basically all manufacturers had exhibited LED products (notes-2010-07).

Nevertheless, uncertainties remained. Conversations circled around the reliability of the technology, the trustworthiness of manufacturers, and their chances to survive or profit from the crisis in their field. Professional users expressed their doubts about the light quality of LEDs and their usefulness. A civil engineer from Berlin recalled: "[In] 2010 there was nothing but LEDs at L+B. Everybody absolutely wanted LEDs and nobody knew exactly how they worked" (Interview 2012-12-11). This uncertainty was intensified by the lack of standardized product information (CELMA 2011), making it difficult for customers to compare new and old technology. Given this situation, product displays gave visitors the opportunity to form an opinion that was not based on the manufacturers' promises and hearsay but on their personal visual and first-hand experience. LED luminaires were often presented in formats that facilitated a direct comparison between products highlighting the good quality of LED solutions. Since light quality can only be appreciated when light is reflected on material surfaces, stand designs and objects were crucial in these settings. The displays often evoked familiar and easily recognizable situations like shop interiors or outdoor scenes (see image 1.). They created "as if" situations that allowed visitors to experience compare and evaluate LED products with their own eyes. Debunking a common concern that LED lighting is cold-white and uncomfortable, these comparative formats showed that LEDs provide good light quality and perform as good or even better as conventional light sources.

[Insert image 1 about here]

However, good light quality is a prerequisite rather than a sales argument. So, to sell their products, manufacturers also promoted the new features of their LED products, particularly by providing evidence that LEDs can be easily controlled and offer new design options.

The buzzword was “flexibility” and it was used in most product presentations (notes-2010-04). Several manufacturers equipped their booths with devices for dimming and changing light colors. Such displays allowed users to play around, press light switches and thereby explore the flexibility of LED technology through familiar routines. They invited visitors to see with their own eyes that LEDs can be digitally controlled, gradually dimmed, and that color temperatures can be changed from warm-white to cold-white light, which is not so easy with conventional products (see image 2). Thus, they translated the abstract concept of flexibility into a truly hands-on experience.

[Insert image 2 about here]

In sum, L+B product displays allowed potential LED users to *experience* the innovation in elaborately designed socio-material settings. Their particularity becomes apparent when comparing them to trade fair formats that are designed for conveying innovation-related information such as workshops and conferences. During L+B, workshops and conferences took place in separate spaces at the fringes of the exhibition. They were events in the event for which trade fair visitors left the exhibition buzz to discuss LED developments in quiet spaces with business partners and other stakeholders of the lighting field. Here, LED technology was not physically installed but *reflected on* in presentations and panel discussions. Presenters and participants addressed standardization issues, EU innovation policies and programs as well as obstacles in the LED diffusion process.

To conclude, LED installations during L+B encouraged professional users to engage with and evaluate the new technology. *“As if” displays* staged brand-new products referencing familiar usages of lighting technology. *Interactive displays* invited trade fair visitors to test the new flexibility and tunability of LED light levels and color temperatures.

Missing displays during LumiVille: Field-level dynamics in the French lighting scene

The LumiVille case shows that the provision of product displays for user-innovation interaction is not a common feature of trade fairs but event-specific. The Lyon-based trade fair is less international than L+B and targets a more specific market in the field, namely the urban lighting scene, particularly in France. Nevertheless, both events attract the same professional user groups, including lighting designers, light planners and visitors with urban lighting backgrounds such as civil engineers, urban planners and politicians. Reflecting Lyon's outstanding role in public lighting, "LumiVille was created in order to bring together all those involved in illuminating cities" (Grand Lyon 2010). In 2010, the exhibition area was about ten times smaller than that of L+B. It was hosted on the ground level of one single hall, which also included recreation zones, meeting and conference spaces. Signage, not halls, thematically subdivided the exhibition areas. Workshops took place *within* the exhibition hall behind screen-like walls. Business meetings were held in a lounge tent or backstage in booths. During LumiVille 2010 corporate stands did not compare to the impressive multi-level L+B architectures. A group of French municipal engineers who had hoped to gain insights about LED lights left the event unsatisfied. One complained that "there was not much too see" (notes-2010-06). Sophisticated LED installations and displays were missing. So were key players of the French lighting industry. The official explanation was that in times of economic crisis, they had spent their marketing budget on L+B in April 2010 and had no resources left for the Lyon trade fair in June. However, insiders saw it as a boycott aimed at pressuring the LumiVille organizers to adapt the event cycle to alternate with L+B. Two years later, LumiVille changed from annual to a biennial rhythm (newsletter 2012-08-30).

Nevertheless, LumiVille 2010 offered professional users insights into the innovation activities in the field. Information *about* LED lighting was conveyed in workshops, panel discussions, press announcements, and personal conversations. Since all the activities took place under one roof in the same hall, networking and information exchange was much more observable than

during L+B. In particular, a tent in the middle of the exhibition hall, where the event organizer, a Lyon-based agency, held press conferences and offered food and drinks, provided a semi-private meeting spot. Observing this gathering of the French lighting scene, it was quite easy to tell who was important and who knew each other. This was not the case during L+B, where networking activities were more dispersed and much less obvious due to the huge size of the exhibition grounds. To conclude, LumiVille 2010 offered little formats for user-LED interactions but various occasions for observing institutional dynamics in the lighting field.

« Bricolage » during Fête des Lumières: Exceptions from the routine

Fête des Lumières is renowned worldwide as the trademark of Lyon, the "City of Light". The annual festival has its roots in a 19th century religious candle procession that was turned into a municipal project. In 1999, the city transformed the one-day catholic celebration on December 8 into a four-day public spectacle (Djaoui and Poirieux 2007). Today the festival attracts millions of visitors, including delegations of professionals from the lighting field.

The festival is organized by a municipal festival team. The City of Lyon shares the costs with private sponsors, including LED manufacturers. The international festival offers its presenters an opportunity to show their skills and installations in front of lay as well as expert audiences. Most presenters are artists, lighting designers and students of light- and art-related disciplines. But also the public lighting department of the City of Lyon participates in the festival and presents a light installation every year. The festival curator explained that he often offers them sites that are technically and topographically challenging and require an intimate knowledge of the locations (Interview 2010-06-02). Indeed, the Lyon public lighting department is renowned for its expertise in urban lighting and LED manufacturers describe the municipal light planners as "demanding" and "prudent" clients (Interview 2013-10-04). Their usual job is to ensure appropriate light levels in public spaces. During the festival however, they work

extra hours—a lighting engineer reported that he “does not go home” during the festival—and use extraordinary lighting equipment to illuminate urban spaces in extraordinary, site-specific and novel ways.

In 2011 the public lighting department produced a light-and-sound show in a sloping public park (Ville de Lyon 2011). The show was designed by a municipal light planner. A public pedestrian stairway, trees, and surrounding facades were dynamically illuminated with changing colors, and the park was populated by fairytale-like characters formed from LED garlands.

The fairyland had emerged collaboratively. Children from neighboring kindergartens who had been invited to participate in the festival project provided the motifs. Based on the children’s drawings, a team of maintenance workers built colorful LED sculptures in the yard of the municipal lighting department (image 3). They also set up the handmade “bonhommes” in the park, together with color-changing floodlights. During several site visits they adjusted the installation to the terrain. To digitally program the sound and light, the municipal planners collaborated with an event lighting firm.

[Insert image 3 about here]

For the municipal team, the festival represents a break from their usual work routines and an opportunity to experiment. The municipal technicians were previously not familiar with the event lighting equipment, and the festival gave them the chance to explore it. The municipal workers enjoyed the extraordinary artistic work and seemed proud of their results. The head of public lighting referred to the event as an opportunity for team work and for developing professional skills: “Some are more creative and others are good with the technology […] the youngsters are still learning” (Interview 2011-11-15). Similarly, the head of planning described their festival work as “tinkering” (French: *« bricolage »*) and suggested that it had a positive impact on their everyday public lighting business (conversation, 2011-12-02).

The creative tinkering is perfectly in line with the municipal departments' interest in innovation and life-long learning. The Lyon lighting engineers strive to stay ahead of the developments in their field and to justify their reputation as pioneers in urban lighting (Schulte-Römer 2015, 262). As the interviewees suggested, the four-day festival allows them to take risks that would be unacceptable when lighting the streets of Lyon. It also offers the municipal team an opportunity to display their work and professional skill in front of an appreciative public, whereas their everyday public service is mostly overlooked or only criticized (2011-11-15, 2011-12-02). In the described case, the positive public response culminated in an invitation of the project to the Singapore Night Festival in 2012 (Lee 2012).[5]

Design work during Luminale: Developing a smart LED cloud and professional skills

Luminale was founded in 2002 as L+B side event. Since then, the festival and its temporary illuminations and performances have spread all over the Rhine-Main region. In contrast to the Lyon festival, Luminale is organized by a small and private marketing team that is commissioned by Messe Frankfurt. The festival curator emphasizes that the L+B organizers do not interfere with the festival program. His vision is to promote an urban "light culture" rather than to create a city marketing event (Interview 2010-02). Artists and lighting designers respond to open calls for projects. They develop projects on their own initiative and with their own funding. Installations are often realized with private sponsoring. The festival curator has no artistic budget. Like the Lyon festival, Luminale temporarily transforms public spaces into sites for artistic, experimental engagements with lighting technology and hence encourages user-LED interactions in the form of festival projects. The following case of a student project is an example of a highly successful project that received a lot of public attention in 2010.

[5] This was not the first time that the Lyon lighting department exported their art and skills. In fact, they regularly design lighting projects abroad, including an artistic installation in the Luminale city Frankfurt in 2010 (Bien 2010-07-06).

The project was an interactive light-and-sound installation which synchronized a cloud of 1,600 LEDs with spherical music via a digital interface. But that wasn't all. The light-and-sound system was also interactive. When festival visitors jumped on a round platform on the ground, it sent impulses to the LED system and made the lights blink.

The project had been developed by a group of media and lighting design students from a nearby University of Applied Sciences. During the month-long preparation phase, these junior professional users actively engaged with LED technology to develop and deploy their envisaged interactive, innovative design. Like in the Lyon case, the process from image to installation involved a lot of tinkering (see image 4), which is also documented in a time-lapse short film (see making-of video Muxel 2010). The media design professor pointed out that the installation would have been unjustifiably expensive in a commercial situation. But since festival projects "do not follow economic laws" they could "experiment a lot", which also involved "a lot of manual labor" performed by enthusiastic students (Interview 2011-09-13). In particular, the students cut out 3,200 aluminum strips to make sure the backs of the LEDs also sparkled. They bent the strips round the LEDs and attached each of them with cable binders so that the light was reflected in all directions (Muxel 2010). The advising professor described the solution as "simple and beautiful".

The lighting design professor remembered that in the beginning of the project there was only a "beautiful image" of how the installation should look. "If we had already started at an early stage to think 'can it be done?' we probably would have stopped the project" (Interview 2011-09-07).

[insert image 4 about here]

The student LED users not only interacted with the new technology, but also with its producers. A light manufacturer sponsored part of the technology and provided theoretical know-how. Since the firm itself had little practical experience with the innovative interactive lighting system, the students themselves worked out how to apply it in practice, that is, how to

interactively control the brightness and color of every single LED. The LED sponsor benefitted from the students' efforts as they were able to detect and solve software problems. As the festival took place in parallel with L+B, the firm also took its clients to see the project. The students' efforts were rewarded by the festival public. Press reports praised the project and its sparkling LEDs. Although the labor-intensive and site-specific project was not suited for reproduction and commercialization, it outlived the festival. Through the project the students gained an understanding of interactive "intelligent" lighting systems and formed a relationship with the 1,600 LEDs their university had purchased for the project. As their lighting design professor reported, some of them became "LED moms" who felt responsible for the new equipment and shared their skills and knowledge with their peers in subsequent student projects (Interview 2011-09-07).

6. Comparison and discussion

The four case studies show that LED installations in trade fairs and festivals both allowed professional users of lighting technology to engage with the innovation in extraordinary situations. As expected, the event formats shaped these encounters in very different ways. Moreover, the rather unusual LumiVille case shows that socio-material formats are neither fixed nor independent of each other and can vary within the same event type. In this section, I compare the four cases, starting with trade fair formats for user-innovation interaction, followed by festival formats. In the last step, I contrast the two event types.

Trade fair LED installations: Adoption formats for gaining certainty in uncertain times

Trade fairs are generally organized to display innovation and to create new markets. During L+B, LED installations dominated the look and feel of the exhibition, thereby creating a "sensory overload" (Power and Jansson 2008) and "global buzz" (Bathelt and Schuldt 2010). In contrast, the atmosphere during the 2010 edition of LumiVille rather resembled a quiet get-together of the French lighting scene and LED installations were practically missing. Without

a “global buzz” the Lyon trade fair offered the French lighting scene a perfect meeting place but seemed less suited to facilitating socio-material user-innovation interaction.

In the L+B exhibition, LED installations had been ubiquitous. Visitors reported after the event that L+B 2010 had signaled that LED technology was now mature. Product displays not only appealed to professional users but to all light users, including lay end users. They were designed to pave the way for the adoption of new products, i.e. to create a market for LED products, and thereby evoked standard light applications rather than a need for adaptation. I therefore consider them as *adoption formats*.

During L+B 2010, I identified two “genres” of adoption formats, that is “types of communicative action that serve as templates for interaction” (Zilber 2011, 1546). They both *reproduced familiar uses of lighting technology* rather than suggesting radically new uses of light. On the one hand, the new light was featured in artificial but *familiar “as if” displays*. Such displays allowed visitors to experience and evaluate the light quality of LED products with their own eyes and countered their reservations by providing visual evidence that LED luminaires performed well or better than conventional light sources. The imitation of familiar settings (image 1) made it easy for potential LED users to let the new “enter into exchange with prior experiences” without having to install and actually use it in their “familiar worlds”, as Nowotny suggests (2008, 2). On the other hand, *interactive displays* rendered the advantages of the new technology more tangible by presenting tunable and dimmable LED lights (image 2). They substantiated sales arguments like “flexibility” or “smart solutions”, making it easier for potential users to recognize and evaluate “the new”.

From the micro-analytical STS perspective, both genres enacted LED technology *in familiar configurations and routine socio-material “scripts”* (Akrich and Latour 1992; Oudshoorn and Pinch 2003). “As if” displays highlighted the good quality of LED products and interactive displays presented new LED features. Both made LED products *comparable to conventional products and uses* of lighting technology.

With regard to potential effects, both genres were designed to create demand for LED products that were ready to use and on the market by *generating certainty* regarding their quality and new performance features. Meanwhile, uncertainties regarding the innovation process still remained and were addressed in different formats in the trade fair, e.g. in conferences at the fringes of the event. Here, in the absence of LED products, LED producers and users openly discussed and criticized missing quality criteria, market failure or misleading product information (notes-2012-04). This ambiguity resonates with Garud's above-mentioned observations regarding the two types of persuasive discourses that unfolded simultaneously during a field-configuring conference on innovative cochlear implants. Like in Garud's case, the L+B adoption formats contributed to a "narrative discourse" that connected facts, artifacts and high status people "by co-occurrence, spatial proximity, formal similarity or metaphor" with the aim to "win the hearts and minds" of its participants (2008, 1069 and 1081). Garud concludes that this associative mode of presenting innovation is particularly salient in open technological races where reputation and status seem more convincing than technological promises and unproven scientific facts (cf. Rao 1994). This corresponds with the described situation, in which incumbent European manufacturers and their LED products were much more prominent in the L+B exhibitions than their Asian competitors who presented their products in a different hall at the fringes of the fair ground.

I conclude that L+B adoption formats allowed associative persuasive user-innovation interactions that generated certainty despite the ongoing technological development and crisis in the lighting field. Incumbent European light manufacturers were thereby most visible and potentially more persuasive (cf. Moeran 2011, Power and Jansson 2008) as they used their resources to *materially "script" and "configure"* their product displays in convincing ways.

Festival LED installations: Adaptation formats at the fringes of the lighting field

Compared to trade fairs, festivals at the fringes of the lighting field seemed less exposed to the innovation dynamics and pressures at its center. Incumbent technology producers sponsor festival projects with money and equipment, but artists and designers are in charge of the design process and the festival presentations. While comparing user-LED interactions during Luminale and Fête des Lumières I found striking similarities—despite the differences of the two festivals—and categorized both festival projects as *adaptation formats* for extraordinary professional user-innovation interaction. This categorization stresses that "to adopt is to adapt" (Akrich, Callon, and Latour 2002), whereas the adaptation concerns both the artifacts and actors involved in LED installations. Such mutual adaptations could be observed in both festival projects.

To realize their project ideas, both festival teams *adapted LED products* by translating them into multi-media installations in concrete socio-material configurations. The students in Frankfurt created an interactive LED cloud and found a way to install the 700kg object over a pond in a public park where heavy cranes were not permitted. By attaching simple aluminum strips to 1,600 LED points they managed to disperse their narrow beams into all directions. The Lyon municipal lighting engineers brought conventional LED garlands into the shape of fairytale characters drawn by local kindergarden children and staged them together with color-changing LED projectors and music in a public park. Both LED installations exploited the *flexibility and controllability of the new technology in interactive and customized ways*. The designated festival sites set limits to the design options and created problems that were solved through material adaptations and *« bricolage »*, as the Lyon light planner called it.

"Bricolage" is a familiar term in innovation research (cf. Duymedjian and Rüling 2010). Here the concept is used to link the resourcefulness of actors—their "making do with what is at hand"—to entrepreneurial success (Baker and Nelson 2005, 329). Drawing on Lévi-Strauss', Garud and Karnøe use the concept to describe a particular style of "technological

entrepreneurship" that involves the "co-shaping" of technology by actors "who possess local knowledge" and closely interact "in situations characterized by complex non-linear dynamics" (2003, 296). Bechky and Okhuysen refer to "organizational bricolage" to explain how teams successfully handle surprises by interacting with their environment (2011, 240). Based on these findings, I consider the creative bricolage in extraordinary festival situations as a form of organizational capacity building, which is particularly salient in situations of institutional and technological change.

On the other hand, "bricolage" also suggests that the actors involved learnt (Garud and Karnøe 2003) and hence adapted *themselves*—their skills, prior experiences and knowledge—to the new technology. Festival adaptation formats offered students and municipal light planners opportunities to explore their roles as professionals in an innovating field. From the perspective of the Sociology of Translation this formation of user-innovation relationships can be interpreted as a form of up-scaling (Akrich, Callon, and Latour 2006). Although the LED "adoption" in festivals was only temporary, it *translated* the municipal staff and the students into LED users by allowing them to tinker with and relate to the new technology. This tentative formation of new relationships was not confined to LED technology but also included LED producers and partners with know-how in interactive light-and-sound design. Last but not least, the newly formed temporary relationships were reinforced by positive public feedback. Successful as they had been, both projects had an afterlife, despite their site-specific and customized LED solutions. The Lyon municipal lighting department exported its project and professional skills to the Singapore Night Festival 2012, strengthening its international professional relations and reputation as a pioneer in night-time urbanism. The University of Applied Sciences profited from the positive public appeal of the project, which also won a design prize (Hochschule Mainz 2010-12-06), and could draw on the students' experience with smart LED solutions in later projects. Moreover, the user-producer interactions during the Luminale project offered the students an opportunity to engage in

transdisciplinary collaborative design with industry partners and build their professional network. However, these opportunities also had a price. In contrast to trade fair adoption formats, festival adaptation formats were costly for professional users as I will outline next.

Festivals vs. trade fairs: Event-specific formats for extraordinary familiar interactions

Temporal and spatial boundedness and functional unboundedness make event situations extraordinary and distinguish them from ordinary situations (Moeran and Pedersen 2011, 6-7). However, my comparison of trade fairs and festivals shows that their socio-material settings varied considerably and allowed more or less un/bounded user-innovation interactions. In particular, *trade fair formats facilitated shorter, spatially confined and familiar engagements with LED.* In contrast, *festival formats facilitated time-consuming, spatially distributed and familiarizing exploration*. While L+B displays allowed professional users to gather information within minutes, the festival projects implied long-term commitments. The site-specific LED installations during Luminale and Fête des Lumières were the result of intensive week-long preparations and design processes. Trade fair exhibitors staged their LED installations in carefully "scripted" booth architectures with the intention to persuade visitors of *preconfigured familiar LED applications*. Conversely, the festival teams tinkered with and "descripted" LED technology quite freely in more than one site. The Luminale project was conceived in the university; test installations were built in a workspace they had rented specifically for preparing the event; the final installation was staged in a public park that the festival curator had assigned to the project (image 4). Similarly, the Lyon public lighting team prepared their challenging public installation in the workspaces and courtyard of their municipal department before they presented it in an urban space (image 3).

Thus, both event formats linked extraordinary interaction to ordinary familiar situations, but in very different ways: In trade fairs, functionally *bounded* innovation displays evoked familiar routines and lighting standards in otherwise extraordinary situations. In festivals,

temporally and spatially unbounded projects had familiarizing effects on their participants. In this sense, festival formats seem better suited than trade fair formats when it comes to protecting "individual initiative and creativity from the relentless isomorphic pressures of institutional field logics", as suggested by Lampel and Meyer (2008, 1028-29).

Furthermore, it has been argued that events can reduce the cost of selecting new products on the demand side (Potts 2011). My findings support this argument for trade fairs but not for festivals. As suggested by several interview partners, L+B displays made it easy for professional users to compare and evaluate LED products and make informed product choices. In this sense, the L+B adaption formats created a "novelty bundling market" (ibid). In contrast, festival projects were costly for professional users. They not only had to develop and maintain their interaction formats themselves and in different places, but also invested a lot of manual labor and time in shaping LED technology to meet their demands. Considering the time-consuming creative process, I conclude that the effects of festival interaction can be better described in terms of mutual adaptation—technology shaping, learning and network formation—than in terms of market creation, as outlined in the following.

Understanding socio-material event settings in the context of innovation diffusion

So far, we have seen that LED installations during trade fairs and festivals facilitated professional users' engagement with innovation in event-specific ways. However, did the event formats for user-innovation interaction have any effects on innovation diffusion, or more specifically, the "LED revolution" in Europe's "world of lighting"? The proposed theoretical framework allows me to infer such effects from my findings.

First, economic and geographical research suggests that socio-material event settings can contribute to the creation of value chains and markets by reducing the cost of selecting new products on the demand side (cf. Potts 2011) and by creating a highly informative "sensory overload" or "global buzz" with cluster-like effects on innovating industries (Bathelt and

Schuldt 2010, Power and Jansson 2008). My findings support these arguments for the L+B trade fair, but not for LumiVille or the festivals. As several professional users suggested in interviews, L+B displays made it easy for them to compare and select LED products. The contrasting case of LumiVille 2010 offers a negative example where the absence of socio-material settings for user-innovation interaction seems to have reduced the cluster-like effects of the trade fair. Furthermore, the micro-analysis of L+B displays could substantiate the "novelty-bundling" thesis empirically by outlining how exhibitors presented uncertain new technology in highly "scripted" and familiar formats allowing professional users to recognize and compare novelties more easily.

Looking at festival formats for user-innovation interaction, economic and geographical concepts seem less suited to explaining their potential effects on innovation diffusion. Although both festival projects eventually added to the "global buzz" and "sensory overload" of Luminale and Fête des Lumières, the LED users' week-long and intense experience went far beyond these nightly displays. Festival projects also did not bundle novelty or reduce the lighting and media designers' or municipal light planners' cost. On the contrary, they were time and labor-intensive for LED users.

The effects of festival formats can therefore be better described in social-constructivist terms as adaptation and "translation" (cf. Akrich, Callon, and Latour 2006). When this research was conducted, "smart" interactive LED solutions were a big issue, but their advantages uncertain. In this situation, extraordinary festival formats 'translated' professional users into co-producers of such interactive digital LED light-and-sound installations. As my observations show, the LED installations involved user "bricolage" and the "description" and situated shaping of the new technology. User-producer interactions seemed institutionally rather unbounded and followed neither economic laws nor conventional lighting routines. The positive public feedback in the form of news reports, invitations to other festivals and an

award, validated the LED users newly learnt skills, their relationship with LED manufacturers and their creative LED solutions.

These "translations" and new user-innovation-innovator relations seem highly relevant with regard to the development of LED demands and solutions "in the diffusion stage" (Bijker 1992). LED technology offers radically new design options, but manufacturers of LED lighting still produce conventional retrofit solutions and depend on professional users when they develop and test new light applications (Schulte-Römer 2015). In this regard, festival formats for user-innovation interaction might qualify as extraordinary temporary sites for user innovation (cf. Schulte-Römer 2013a, Hyssalo, Jensen, and Oudshoorn 2016). This resonates with research on user innovation that shows that "market distance" and experienced "lead users" have a positive influence on their contribution to "truly novel solutions" (Hienerth, Pötz, and Von Hippel 2007, 23-24).

In contrast, trade fair formats seemed less likely to provoke new uses for LED lighting. As outlined, L+B displays configured user-innovation interactions in familiar and conventional, rather than revolutionary ways. They were designed for all visitor groups—"configuring the user as everybody" (cf. Oudshoorn, Rommes, and Stienstra 2004) and suggesting that LEDs were ready to be widely adopted, rather than inviting professional users to further develop and adapt LED technology.

The field-theoretical lens puts the user-innovation potential of festival formats into perspective. In terms of field-configuration, festivals seem unlikely to be "steppingstones for processes of 'disruptive' systemic change" (cf. Nissilä 2015, 209). Instead, I hypothesize that event formats for user-innovation interaction are generally more likely to *maintain fields* than to reconfigure them. On the one hand, explorative user engagements took place at the fringes of the innovating field where field pressures could be suspended for a while. This resonates with Schüßler's and Sydow's argument that field configuration and maintenance are "strongly mediated by an event's position in a field" (ibid, 290). On the other hand, incumbent firms

create the most visible trade fair formats (Moeran and Pedersen 2011). Again, micro-analytical STS concepts can add to a better understanding of the socio-material dimension of field-maintenance (cf. Schüßler and Sydow 2015). As outlined above, sophisticated L+B displays were "scripted" in familiar ways that challenged neither existing light uses, nor established lighting institutions. Thus, they rather seemed to stabilize the European "small world of lighting" than to revolutionize it. Conversely, LumiVille 2010 maintained the order in the lighting field in negative terms through the absence of product displays.

Finally, the comparative research design and focus on socio-material settings also raises the question of how events are interrelated in an innovating field (cf. Iordanova and Rhyne 2009). In particular, my observations suggest that powerful actors can *stage events low* in relation to "high stake" events (Schüßler, Rüling, and Wittneben 2014) by investing more or less in their socio-material settings. In 2010, LumiVille turned out "low stake" because incumbent manufacturers considered "LED+Building" 2010 as very "high stake" and chose to spend their entire marketing budget on their Frankfurt appearance. This so-called boycott and the subsequent change of the LumiVille schedule to a two-year interval alternating with L+B can be interpreted as an exemplary case of a *socio-material event-configuring effect*. Again, the field-level effect seemed more maintaining than revolutionary. It remains a question for further theoretical discussion whether hierarchically interrelated *events configure events* in "cyclical clusters in global circuits" (Power and Jansson 2008) or whether *field dynamics configure events* in "event ecologies" (Roche 2000, Schüßler, Dobusch, and Wessel 2014).

7. Conclusion

This study focused on the socio-material dimension of user-innovation interactions in event series to further explore the theoretical claim that events function as "mechanisms of innovation diffusion" (Schüßler, Grabher, and Müller-Seitz 2015, 168). It was sparked by the empirical observation that the latest innovation in lighting, LED technology, was first

installed in lighting trade fairs and light festivals before it was adopted in the real world. To analyze the variety of event-based LED installations I developed a conceptual framework and compared event formats for user-innovation interaction across event types.

One first important insight was that innovation users attend and move between different event types *in different roles*. In the lighting world, light planners and lighting designers visit trade fairs as *visitors* and act as *presenters* during festivals. The role switches allow them to *experience and test* ready-made LED displays in trade exhibitions and *actively produce* LED installations for festivals. In innovation research on events, such role switches have so-far not been taken into account but might be worthwhile exploring as they coincide with distinct socio-material interactions.

In this respect, this study showed that socio-material trade fair and festival formats for user-innovation interaction are *event-specific*: L+B displays did not compare to the LumiVille exhibition. Fête des Lumières offers much more public support to festival projects than Luminale. Nevertheless, event types shared structural features. *Trade fair formats* ideally facilitate short and spatially confined user-innovation interactions. They are designed by incumbent exhibitors to create demand for existing products and offer professional users the chance to try, evaluate and select innovation efficiently. In contrast, *festival formats* are created collaboratively by user-innovator teams and engage professional users over weeks and months. They allowed them to explore and tinker with new technology and to develop new solutions and relationships with their industry sponsors, but at their own expense.

Focusing on the LED innovation in 2010, trade fair displays promoted the adoption of the latest new lighting solutions on the market, while festival projects offered professional users time spaces for creating their own LED solutions by adapting the technology and their professional skills to the innovation. Based on the proposed theoretical framework, these effects can be described in terms of market creation and technology shaping, whereas the effects on the European “world of lighting” seem rather field-maintaining than field-

configuring. This is due to the fact that the socio-material structures of organized events tend to reflect the power dynamics and unequally distributed resources of their fields.

The implications of this exploratory study are twofold. First, it revealed the advantages and limits of three different theoretical lenses on events and innovation. Economic geographical concepts capture the cluster-like effects of trade fairs on innovating industries, but have so far concentrated on face-to-face interaction. This study shows that the analysis of *face-to-product interactions* can add a better understanding of the "global buzz" or "sensory overload" in trade fairs (Power and Jansson 2008, Bathelt and Schuldt 2010, Maskell, Bathelt, and Malmberg 2004). Studies on science, technology and society (STS) add to this by revealing the "scripted" and "configured" socio-material dimension of apparently spontaneous event interactions (Oudshoorn and Pinch 2003, Akrich, Callon, and Latour 2006). Their micro-analytical lens also helps to explain how event formats materially reproduce or challenge the "relentless isomorphic pressures" of organizational fields (Lampel and Meyer 2008). Vice versa, organizational research on field-configuring events (FCE) draws attention to field-level dynamics and power plays that explain why trade fair displays at the center of the lighting field are more purposefully and resourcefully configured than festival formats for user-innovation interaction at the fringes.

Secondly, the focus on structural features—duration, spaces and de/scripted modes of interaction—might also be conducive for the analysis of other user-innovation formats, which gain relevance in the context of current demand-side innovation policies (OECD 2011). These policies move the locus of innovation both virtually and physically from the producers' labs into the users' familiar worlds, blurring the boundaries between innovation production and adoption. For instance, "living labs" and pilot projects are specifically designed to allow innovation users to test, evaluate and shape new technologies in the real world (Schulte-Römer 2015). My findings suggest that event formats for user-innovation interaction can have similar effects if they are not too narrowly configured. Against this backdrop, it might be

worthwhile exploring whether event series can function as “niches” for technological transitions at the fringes of innovating fields (cf. Nissilä 2015, Schot and Geels 2008). Another open question is how learning effects and creative solutions can outlive their temporary event formats and what innovators and innovation users can learn from extraordinary event interactions before they install the new in their familiar world. Last but not least, the generalizability of these findings beyond trade fairs, festivals and the European “world of lighting” remains to be explored. In this respect, the proposed multi-level framework can offer a useful conceptual toolkit.

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