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Understanding the socio-technical hybridisation of indoor–outdoor relations: Emergent, merged, and stretched

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Indoor and outdoor leisure environments are increasingly understood to be mutually constituted through merged relationships but there has been less focus on the actual forms that hybridisation can take. This paper provides an analysis of forms of hybridisation through time by focusing on the socio-technical configurations through which three leisure environments are materially constituted. We analyse the key functional elements of these configurations: the technological systems and their genealogies over time that allow the making and unmaking of activities; the spatiality of facilities and systems in terms of their locations and connections across space; and the construction by providers of user pathways between indoor and outdoor activities. The paper uses this structure to compare purpose-built indoor recreational spaces located in the city region of Greater Manchester that recreate outdoor activities focusing on skydiving, skiing, and ice wall climbing. We construct a framework of three modes of hybridisation – emergent, merged, stretched – that contributes a deeper understanding of the diversity, intensity, and changing temporality of interrelations between indoor and outdoor environments.

KEYWORDS
Greater Manchester, hybridisation, indoor, leisure, outdoor, sociotechnical

1 | INTRODUCTION

Consideration of the fluid character of indoor and outdoor environments, and the shifting relations between them, has been a concern for at least two decades in the social sciences and has been productively addressed in this journal (see, for example, Couper & Yarwood, 2012; Eden & Barratt, 2010; Gibbs & Holloway, 2018; Hitchings, 2007; Tivers, 1997). These contributions have shown that the indoor/outdoor binary in a range of consumption environments is blurring as people seek accessible, all-year-round leisure activities irrespective of whether sites are artificial or located in "nature." To explore this shift, a relational perspective is commonly adopted, viewing the indoors and outdoors as hybrid spaces that are formed through a complex mix of materialities, temporalities, and practices that are combined in new formations that are merged, twisted, and stretched in and through each other, disturbing taken-for-granted binaries (cf. White et al., 2016).

The aim of this paper is to examine the processes through which hybrid formations of indoor–outdoor are produced and comprised as temporarily stabilised configurations. This focus is of relevance to a number of domains – including food production and nature conservation as well as leisure activities – in which previously clear internal–external distinctions are now blurred. Our contribution is to find a way of understanding hybridisation that takes into consideration geographical and other differences as well as the various ways in which specific formations come to be intertwined. A first issue is that

hybridisation cannot be equated with unordered mixing of indoor and outdoor components but needs to be seen as an always emergent process through which indoor and outdoor are mutually constituted and come to exist in conjunction in varying ways and to differing degrees (see Biehler & Simon, 2011; Hitchings & Latham, 2016). The second issue is that a hybrid perspective focuses on the processes that both make and unmake the connections between indoor and outdoor activities – including how relations are formed and hold together over time, and how they are shaped through technological, economic, and cultural change.

Consequently, the paper provides an analysis of the specific forms and historic trajectories that hybridisation takes over time through a focus on the socio-technical infrastructures that enable providers to construct an artificial leisure environment. Socio-technical infrastructures are the embedded and heterogeneous systems for enabling particular activities that are historically constituted over time and have a stable and regular quality (Star, 1999; Thrift, 2005). These infrastructures underpin the production of fabricated highly engineered indoor environments offering predictable, optimised, and secure experiences that meet the expectations of consumers without the challenges and dangers of outside activity (see Ritzer, 1996, in Eden & Barratt, 2010). These "experience landscapes" (Gibbs & Holloway, 2018) are not a replication of an existing nature but a creation of an artificial nature that does not actually exist anywhere else (Marvin & Rutherford, 2018). Furthermore, it has been proposed that it is increasingly difficult to distinguish in leisure environments "between where the natural ends and the simulated begins" (Forrester & Singh, 2005, p. 75), pointing to the hybridity of such configurations.

Yet the central importance of socio-technical infrastructures in the production of artificial environments has been subject to little critical analysis, despite their threefold role in enabling hybridity. First, they require technological systems that manipulate specific parameters of temperature, humidity, airflow, etc. to produce a specific material effect and create a reliable enclosed microclimatically controlled environment, suitable for particular activities. The task here then is to explore briefly the genealogies of these socio-technical systems – when and where they were developed and applied and how their configurations have changed over time. Second, the leisure providers have to select the location of these facilities, which depends on the mobility of systems and whether the design parameters can be configured for different locales. The task here is to focus on the spatiality of the facilities, whether they are located in urban areas and/or in other contexts, and identifying the elements of outdoor environments that are filtered out and those that are recreated indoors. And third, the providers have choices in how they position the offer as either interconnected to outdoor activities or as a separate entity in its own right. The task here is to understand how the providers relationally configure indoor activities as either bounded or hybridised leisure environments, and the degree to which connections between indoor and outdoor activities are formally or informally constructed. We argue, therefore, that socio-technical systems are both central to the production of "indoor" leisure spaces and provide an essential entry point for understanding the construction of hybrid formations more generally.

We attend to these issues in the next sections by exploring how they emerge at three indoor leisure sites in Greater Manchester – respectively a skydiving wind tunnel, an artificial ski slope, and an indoor ice climbing wall – selected because each involves a socio-technical system that artificially re-creates an outdoor experience indoors. Using site visits, participant observation, and open-ended discussions with providers and participants, in addition to the analysis of historical materials and literatures on the development of indoor/outdoor relations in leisure activities and their socio-technical systems, we outline the specificity of hybrid formations in each activity. The resulting case narratives blend insights from our own experience and encounters at the sites with analysis of the technological components and functioning and relevant discussion of historical developments. Following this analysis, we develop a threefold framework of relations between indoors and outdoors that allows us to provide a more nuanced and historical understanding of the intensity, diversity, and temporalities of these hybrid arrangements and their specific modes of socio-technical composition.

2 | CONSTRUCTING HYBRIDISATION – INFRASTRUCTURES OF AIRFLOW, SNOW, AND ICE

2.1 | Skydiving tunnel: iFLY

On the western edge of Manchester next to the Trafford Centre shopping mall lies a tall metal box of a building that produces a strange whirring sound every 5 minutes. This is an iFLY indoor skydiving centre,[1] where anybody can "soar like a bird" in a 4-metre diameter purpose-built wind tunnel (iFLY website). Indoor skydiving is a well-established leisure experience and sport that has its own World Championships and governing body the International Bodyflight Association. The iFLY concept openly differentiates the experience from outdoor skydiving in terms of what it expressly leaves out: "experience the feeling of freefall as you float on a smooth cushion of air. There's no parachute, no jumping, and nothing attaching you to planet Earth" (iFLY website). Indeed, the improvement over an outdoor skydive is made explicit: "it's not

weather dependent, it's far more affordable" (iFLY website). As iFLY's marketing director explains: "People who don't want to jump out of a plane can come experience freefall conditions in a very safe and controlled environment" (quoted in *Press* Tribune, 2016).

The vertical wind tunnel technology used by iFLY is now standardised across their locations. Four giant fans pump 1.7 million cubic feet of air around a building system reaching speeds of up to 170 mph, allowing a person to "float" safely in a chamber (Figure 1). This "closed recirculating design loop" system with internal air conditioning was specifically introduced in 2004 in order to be able to locate facilities in all climate zones (ISS, 2015). Yet the technology has a much longer history, which, importantly, helps to account for the form and trajectory of indoor–outdoor relations of this activity.

Vertical wind tunnels were initially developed in the 1920s in aeronautical research to test aircraft and the operation of parachutes (Brigg, 2016). The earliest recorded use of a human flying in a wind tunnel was in 1964 at Wright-Patterson Air Force base in Dayton, Ohio, when Jack Tiffany, who was testing the operation of Apollo parachute clusters, successfully "flew" (ISS, 2015). The first wind tunnel built specifically for human flight began construction in Montreal in 1978 and became commercially operational in 1982. Over the next 20 years, only six wind tunnels were constructed, often located near skydiving drop zones to enable skydivers to practice their outdoor routines indoors (Tunnel Tech, 2019).

FIGURE 1 iFly wind tunnel chamber.
Source: Authors

However, from the early 2000s, innovation in the design of wind tunnels significantly improved the quality, speed, and reliability of clean airflow, and enabled four-person training (ISS, 2015). Since 2010, the indoor skydiving industry has expanded rapidly, with 237 facilities in public operation, primarily located in large cities, and a further 26 private operations – often servicing military requirements (ISS, 2019).

The military embraced indoor wind tunnel use as an important part of their training regimes for Special Forces parachutists as the "low cost means we can train a person in freefall well before they jump from an aircraft … in a safe and controlled environment, practice in-air manoeuvres and correct any problems quickly" (Walton, 2019, n.p.). Military customers can now purchase their own purpose-built indoor facilities from vendors such as Tunnel Tech, who emphasise the benefits of full control – an "Inclement Weather Simulator" imitates rain, cloud, and fog, in order to allow troops to train for difficult "insertion conditions" (Tunnel Tech, 2019, n.p.).

Yet, in contrast to these military services that explicitly link indoor and outdoor skydiving in a training programme, the civilian applications in the leisure sector are now configured primarily as a "standalone experience" and do not actively construct a formal relationship with outdoor skydiving. Typically, proflyers – who can be amateurs or professionals – fly solely in the tunnel and "don't necessarily tie it to skydiving" (ISS, 2015, n.p.) so that the indoor sport is "very much its own entity" (ISS, 2016, n.p.). This was further confirmed by the largely separate and formally disconnected worlds of indoor and outdoor skydiving associations and competitions. While the marketing materials of iFLY refer to outdoor skydiving, the actual experience of indoor skydiving does not attempt to replicate an airfield, makes no direct connection with parachute training, and does not allude to the act of jumping out of an aircraft. During our introductory session we were shown how to stabilise the body in the wind flow and then develop the skills and expertise to move through the air, but at the end there was no suggested pathway to outdoor skydiving, and instead we were offered further packages of indoor flying. Our instructor – a national champion standard indoor skydiver who had never parachuted from an aircraft – told us that outdoor skydivers are only a very small proportion of the iFly users (IFly Instructor interview). Yet at the end of our session two outdoor skydivers hired the tunnel for an hour to practice and refine their routine in preparation for an outdoor competition – an example of an informal user-led practice of blending.

In summary, the hybridisation of indoor and outdoor skydiving has followed an uneven pathway. Initially, indoor skydiving provided an opportunity to explore, practice, and improve techniques for outdoor skydiving, yet it is primarily in the military context that this blended relationship has been formally maintained. Modern indoor skydiving is now largely configured, with some informal user-led exceptions, as a distinct and separate activity.

2.2 | Ski slope: Chill Factor[e]

The Chill Factor[e] is a £31 million "indoor real snow centre," one of six in the UK, where for ten years beginners and experienced skiers have hit the slope all year round to sharpen their technique before heading to ski resorts. Located next door to iFLY in a hangar-style insulated building with a massive sloping roof, snow can be seen seeping out of the vehicular entrances/exits. Inside the facility is a simulacrum of an Alpine ski resort, with the décor and the services you would expect along its main street – "the Alpine Street" – a chalet-style restaurant, ski hire, equipment shops, travel agencies marketing "real" ski trips, replicas of iconic old ski lifts, and skis hanging from above. Out on the piste, the walls are covered with snowy mountain images (Figure 2).

The actual 180-metre main slope is quite simple – skiers descend in less than 30 seconds, ascend on one of the two drag lifts in less than 2 minutes, and descend again. Yet, this basic functionality hides a complex infrastructure that makes and maintains the snow from day to day and ensures regularity of temperature between −2°C during the day and −8°C at night (Chill Factor[e] operations team, interview). An industrial ecology of inputs and material circulations is needed to create a controlled setting for skiing that transcends the climatic, seasonal, and topographic constraints of the local, outside environment. The protected milieu of the "box" becomes essential to create the precise conditions for snow production: an insulated structure, a chilled water supply, air conditioning to circulate cold air, a ski slope underlain with a glycol antifreeze cooling system, and a liquid ammonia storage chamber. The infrastructure mimics elements of the outside climate – producing "clouds," "tiny particles," "snow crystal formation" – but sifts out the weather and the inconstancy of natural snowfall. Again, the historical development of this behind-the-scenes expertise and technology is relevant to understanding the contemporary relational formation of indoor–outdoor skiing.

The earliest indoor skiing halls were constructed during the late 1920s and 1930s in major cities in the USA and several European capitals (Hofmann, 2012). Established as temporary uses, these offered a combination of downhill skiing, ski-jumping, and tobogganing, with demonstrations by experts and opportunities for audience participation. The first example of indoor skiing with artificial snow made using soda was when the Schneepalast was constructed in a former station in

FIGURE 2 Chill Factor[e].
Source: Authors

Vienna in 1927 (Hofmann, 2012). The technology of snow production developed rapidly over this early period. The Madison Square Gardens "Winter Sports Show and Ski Meet" held in December 1937 was supported by snowmaking infrastructure. A heavy-duty refrigeration plant produced an estimated 1 million tons of ice, which was ground into tiny white flakes covering the cooled surface of the Gardens for the five days of the show. Prefiguring the design of contemporary indoor ski centres, the show tried to recreate an authentic ski resort – department stores displayed ski equipment and tour companies had booths in an exhibition area marketing ski resorts. The early development of indoor ski slopes was interrupted by the Second World War, which signalled an end to such experiments. It was not until the 1980s and 1990s that indoor artificial ski – as opposed to dry – slopes began to be redeveloped using new techniques of snow production based on the same snowmaking technologies used to produce artificial snow outdoors. There are now estimated to be 105 indoor ski slopes that use artificial snow worldwide.[2]

Outdoor artificial snowmaking systems are actually based on a technology designed to simulate icing for testing jet engines and aircraft in wind tunnels in the 1940s (Bellis, 2019; Leich, 2001). Aeronautical research centres in Canada, the UK, and the USA were experimenting with lab-based testing of de-icing equipment in wind tunnels using water sprays to try to recreate freezing rain, fog, and sleet. Rather than making ice on aircraft wings, these systems produced a product described as "snow" (Leich, 2001). In December 1949, a prototype of this system was taken outside and tested at Mohawk Mountain, producing the first "documented machine-made snow" for outdoor skiing (Ericksen, 1980, p. 70). The system was modified, improved, and tested at various sites until patented in 1954. Artificial snowmaking developed slowly over the next 20 years and took off in the early 1970s. It enabled resorts to offer a consistent product as they could guarantee their opening and closing dates and cope with the uncertainties of "natural" snowfall. This required massive investment in finance,

resources, and networks – especially water and energy plus control and monitoring systems to most effectively utilise snowmaking infrastructure. Most ski resorts now use artificial snowmaking and its use is totally normalised within the outdoor ski experience (Agrawala, 2007).

The relations between indoor and outdoor skiing are therefore complex and intertwined as socio-technical infrastructures moved between different contexts, from wind tunnel testing to outdoor artificial snow systems and back indoors to ski slopes. Even during the inception of indoor skiing in the 1930s, there were aspirations to develop close relationships between indoor and outdoor skiing. Revisiting our experience at Chill Factor[e] illustrates the density and depth of these interconnections. First, through formal partnerships mediated by Chill Factor[e], managed pathways are offered between indoor and outdoor skiing. In order to help fill the summer dip in demand for indoor skiing, competitions are organised with the British Ski Club, starting in the indoor facility in the off-peak season and then transitioning to outside resorts in the winter months (Chill Factor[e] operations team, interview). A training programme for potential ski instructors offers a similar model, starting with indoor instruction before transiting outdoors onto ski slopes. Second, there are multiple forms of co-existence where users themselves can move between the indoor slope and outside skiing for ski practice, purchasing equipment, and booking holidays from the companies present in the Chill Factor[e]. Third, the technologies of artificial snow production are used widely in the outdoor context (Agrawala, 2007; Economist, 2017). Unreliability of weather and climate change with shorter snowfall seasons are leading outdoor ski resorts to increasingly deploy artificial snowmaking technology, thus taking indoor techniques back outside (Scott & McBoyle, 2007). A French resort is even considering building an indoor ski-slope on the mountain side to attract summer skiers (Massemin, 2016).

In summary, the interpenetration of outdoor and indoor snowmaking technologies is increasingly blurring the boundary between inside and outside environments, making it possible to ski on artificial slopes in both summer and winter. The ability to predictably manage and manipulate an indoor ski environment has now become part of the wider ski industry, with a complex transmutation of techniques, practices, and people to and from city and mountain slopes.

2.3 | Ice climbing wall: Vertical Chill

Ellis Brigham Mountain Sports store in central Manchester has all the usual array of mountain equipment for the outdoors, but strangely also on display in a refrigerated triple-glass walled compartment is an ice wall (Figure 3). Vertical Chill offers "real indoor ice climbing" in order "to provide a realistic test environment for beginners and experienced climbers to learn winter climbing techniques, and hone their skills using new equipment" (Vertical Chill website). About 8 metres high and stretching from the ground to the first floor of the shop, the ice wall has three sections offering different challenges from a vertical slab to a tricky overhang of ice. The technology is a noisy bricolage of fans, switches, and blue lights. "Ice free" technology using low voltage heating is deployed from the refrigeration industry so the door does not freeze shut, and other technologies are used here for ambient temperature control creating a constant −12°C, basically transforming the box into a large walk-in freezer. The wall is closed on Mondays so that the staff can manually re-plaster an ice dust and water mix back on to the badly pitted surface in order to reconstitute the ice wall that through use becomes worn again by the following weekend.

Indoor ice climbing using artificial ice is relatively rare, with just three walls in the UK (Vertical Chill has walls in Manchester and London, and the Ice Factor is based in mountains in Scotland), according to the International Climbing and Mountaineering Federation (UIAA), which organises international ice climbing competitions.[3] Vertical Chill in Manchester promotes the wall as an "exhilarating experience for everyone", whether or not you are an experienced ice climber or a "thrill seeker" (Vertical Chill website). Irrespective of prior experience, every user has to book an instructor for the first session, but in future sessions users can climb on their own. According to a manager, most users tend to "visit us for a one-off gifting experience while others are using the wall as a training facility", but only a "small percentage" use it as an introduction to further ice climbing (Ellis Brigham manager, interview). Users are not offered additional packages such as holidays, competitions, or courses to encourage them to transit to outdoor ice climbing.

While Vertical Chill has no wider formal relationship with outside ice climbing, this is not necessarily the case with the third ice climbing wall in the UK. The world's largest indoor ice climbing wall in Kinlochleven in Scotland, called "Ice Factor," is on a much bigger scale, constructed with 500 tonnes of ice, a 12-metre-high wall, replicating freeze–thaw action, and offering both novice and expert routes. Students signing up for outside ice climbing courses are now offered the option of climbing on the indoor wall if the mountain weather conditions are unsuitable. In this specific context, indoor ice climbing is emerging as part of a connected suite of activities in the mountains involving indoor and outdoor space (e.g., Chandellier, 2019). As one instructor states, "we all thought it was a gimmick at first that wouldn't last, 8 years on I don't know what we would do without it" (Ice Factor website).

FIGURE 3 Vertical Chill ice wall.
Source: Authors

In summary, the ice climbing wall can be both a separate and largely disconnected set of relations but can merge in the case where the artificial ice wall is located in the mountains. In this case, a formal relationship is established in the training courses, where the reliability of the indoor activity can make up for what the Vertical Chill instructor called the "normal hassles" of winter mountaineering.

3 | MODALITIES OF HYBRIDISED RELATIONS: EMERGENT, MERGED, AND STRETCHED

Table 1 provides a threefold framework of the different modes of relations between indoors and outdoors that allows us to provide a more nuanced understanding of the varied configurations and changing temporalities of hybrid formations. There are three dimensions to the framework. First, each mode is constituted through an accumulation of socio-technical capacities, spatial topographies, and user pathways that are assembled in specific formations. Second, the specific formations each provide a portrait of the key features of a temporarily stabilised mode of hybridisation, representing a current snapshot that is subject to change. Third, the framework does not represent a linear or sequential pathway of modes increasing in relational intensity. Instead, the historical development of activities exemplifies dynamic and changing trajectories of hybrid formations interspaced with periods of provisional stability. We will consider each mode in turn below, drawing on relevant insights from the case study analysis.

Emergent refers to formations that have largely experimental and exploratory characteristics and that are frequently urban in their initial spatial focus. In both the skiing and skydiving cases, the aerospace sector was important in providing

TABLE 1 Modes of hybrid relations

	Emergent	Merged	Stretched
Socio-technical configuration	Experimental	Intermingling	Separating
Spatial topography	Urban?	Urban and outside	Urban or outside
User pathways	Exploratory	Intertwining	Diverging

Source: Authors

the initial context for the development of the socio-technical system before it was transmuted to a leisure application. While the emergent formation of indoor skiing was experimented with in the 1930s, it was at least 50 years before this became rolled out as a stabilised indoor leisure product. In contrast, ice climbing is still in an emergent phase, where the socio-technical configuration is contingent and bespoke, largely constructed from a bricolage of parts into a working system. It is not totally clear whether it will develop as a leisure activity in the city and/or an indoor alternative to uncertain ice climbing conditions in the mountains. Emergent therefore enables us to capture the experimental and provisional nature of the indoor–outdoor hybridisation in its development.

Merged refers to productively fused interrelations between indoors and outdoors. This formation represents co-produced and intensively joined interactions between indoor and outdoor activities, with evidence of the interpenetration of socio-technical systems and connected formal pathways of activities. The skiing case speaks most powerfully to this merged formation. Key to understanding this is how indoor and outdoor skiing have clearly both experimented with artificial snow-making, and that from the 1970s the two sets of activities have developed in an increasingly interconnected manner. Indoor skydiving developed, initially at least, as a merged activity with sites co-located on airfields and a pathway established between the indoor and outdoor activity. While indoor ice climbing sites based in urban contexts are primarily focused on one-off experiences, there is the example of Kinlochleven, where the activity has become merged over time.

Stretched refers to relations between indoor and outdoor that are quite elastic and may over time shift from merged to a primarily disconnected formation, where the indoor and outdoor activities are the responsibility of distinct socio-technical and spatial-organisational arrangements. The example of indoor skydiving resonates powerfully with this formation. The merged relations developed during the initial development of the activity became displaced as indoor skydiving has developed as its own separate entity located in urban areas, with its own distinct indoor pathway supported by a specialist socio-technical system. Indoor activities are largely viewed as independent experiences and are not formally connected with the outdoor activity. However, there are still examples of merged relations, as we saw in the specialist military application primarily configured around airfields and formally linking indoor and outdoor training programmes.

In all three cases, socio-technical systems are crucial to the production of ostensibly "indoor" leisure spaces in Manchester. But by exploring further both how these systems have developed over time and through linkages between differing domains and locations, and their place within the wider activity landscape at and across specific sites, we are able to understand more clearly their construction of quite distinct hybrid formations of indoor–outdoor relations. In doing so the paper makes two key contributions.

First, it is clear then that indoor–outdoor relations can be constructed in quite different ways and vary over time: they can be merged together, stretched, or emergent. The key point here is that there is always hybridisation where even stretched connections capture the mutually constitutive nature of indoor and outdoor contexts and activities. The continuing and apparent distinctions made between indoor and outdoor across the three cases mean that it is not so much a collapse of the binary into unfettered mixing and fluidity that is at work, but it is more important to analyse how their relations are intertwined in differing ways and to differing degrees over time and across space. We suggest that this framework recognises the diversity, intensity, and also the changing temporality of the relations between indoor and outdoor.

Second, the socio-technical configurations of the climate and environmental control of indoor facilities allow the construction of new artificial environments. This works through selectively importing, adjusting, or filtering out key elements from outdoor ecologies, and then exporting aspects of their internal configuration to outdoor environments that thus become changed through their links to indoor spaces. This extends the findings of existing work on recreational environments by demonstrating the crucial role of particular, often standardised (but sometimes bespoke), socio-technical systems – from snow production to wind manipulation – in actual environmental control that allows people to undertake leisure pursuits in optimal, precise, convenient, and proximate settings. Many leisure sites are located in urban areas, but there is a degree of fluidity – wind tunnels initially developed alongside airports have now moved to urban areas, but military facilities are still often airport-based; indoor ice climbing is emerging as both an urban and mountain activity; and artificial snow production

occurs in both indoor and outdoor contexts and there are even proposals to build indoor ski slopes in mountain ski resorts. Critical to this understanding of the composition of these relations is examining the history of, and changing composition of hybridisation enabled by, socio-technical systems.

4 | CONCLUSION

This paper has offered a framework of different modes of indoor–outdoor configurations – constituted as "stretched," "merged," and "emergent" – that provides an understanding of the fluidity, specificity, and mutually constitutive composition of hybridisation. We showed how leisure activities actually selectively work within and across the binaries of indoor/outdoor, and artificial/natural. These modes of composition are relational configurations of different elements that are always in the making and only temporarily stabilised. Through an analysis of the socio-technical systems that make these relations possible, we showed that hybridised spaces are enfolded through each other in ways that emerge from the specific dis- and re-assembly of particular materialities, temporalities, and practices. Further research on leisure activities may think through the wider sustainability issues that these modes of hybridisation raise for contributing to responses to a more uncertain outdoor climate. On the one hand, indoor artificial environments are highly resource-intensive and carbon-producing, but, on the other hand, there may be substantial environmental benefits from accessible and proximate leisure facilities compared with those that require air travel. Finally, we are not suggesting that the framework is comprehensive. Clearly further research could explore and refine its applicability in other leisure activities and even in additional domains of life such as food and agriculture, where the interrelations between indoor and outdoor are also constituted through socio-technical systems of climate control to create new hybrid formations. If we accept the need to move on from outdated binaries, then we need to constantly refine frameworks to explore and analyse always-evolving modes of hybridisation, understanding their specificity, historical antecedents, and partial stabilisation.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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ENDNOTES

[1] iFLY is a US-based company whose operations started there 20 years ago and that now has more than 50 facilities internationally, usually located on leisure/commercial sites on the peripheries of metropolitan areas.
[2] See https://www.skiresort.info/indoor-ski-areas/ (accessed March 2021).
[3] Indoor walls are also located in the Netherlands, the USA, Canada, South Korea, and New Zealand (UIAA, 2014).

REFERENCES

Agrawala, S., Ed. (2007). *Climate change in the European Alps: Adapting winter tourism and natural hazards management*. Paris, France: OECD Publishing.

Bellis, M. (2019). Who invented the snowmaking machine? *ThoughtCo*. Retrieved from https://www.thoughtco.com/who-invented-thesnowmaking-machine-4071870

Biehler, D., & Simon, G. (2011). The great indoors: research frontiers on indoor environments as active political-ecological spaces. *Progress in Human Geography*, *35*, 172–192. https://doi.org/10.1177/0309132510376851

Brigg, M. (2016). The history of wind tunnels. *International Bodyflight Association News*. Retrieved from https://www.tunnelflight.com/news/other/the-history-of-wind-tunnels

Chandellier, A. (2019, January 11). La montagne en mode 'indoor' [The mountain in 'indoor' mode]. *Le Dauphiné*. Retrieved from https://www.ledauphine.com/montagne/2019/01/11/la-montagne-en-mode-indoor?fbclid=IwAR1T_ooYw7AuwaDDyU6EX_zVklZNtkcQwKOLyqx8NHrUvHko65eSAzdYEjs

Couper, P., & Yarwood, R. (2012). Confluences of human and physical geography research on the outdoors: an introduction to the special section on 'Exploring the outdoors'. *Area*, *44*, 2–6. https://doi.org/10.1111/j.1475-4762.2011.01053.x

Economist. (2017, February 11). Snow-making companies in a warming world. *Economist* (online). Retrieved from https://www.economist.com/news/business/21716659-some-italian-ski-resorts-now-get-complete-coverage-snow-guns-snow-making-companies

Eden, S., & Barratt, P. (2010). Outdoors versus indoors? Angling ponds, climbing walls and changing expectations of environmental leisure. *Area*, *42*, 487–493. https://doi.org/10.1111/j.1475-4762.2010.00943.x

Ericksen, N. (1980). A short history of snowmaking. *Ski Area Management*, *May*, 70–71. https://www.saminfo.com/archives/1989-1980/1980/may-1980

Forrester, S., & Singh, S. (2005). Contrived landscapes: simulated environments as an emerging medium of tourism destinations. *Tourism Recreation Research*, *30*, 69–76. https://doi.org/10.1080/02508281.2005.11081488

Gibbs, D., & Holloway, L. (2018). From experience economy to experience landscape: the example of UK trail centres. *Area*, *50*, 248–255.

Hitchings, R. (2007). Geographies of embodied outdoor experience and the arrival of the patio heater. *Area*, *39*, 340–348.

Hitchings, R., & Latham, A. (2016). Indoor versus outdoor running: Understanding how recreational exercise comes to inhabit environments through practitioner talk. *Transactions of the Institute of British Geographers*, *41*, 503–514. https://doi.org/10.1111/tran.12138

Hofmann, A. (2012). 'Bringing the Alps to the city': Early indoor winter sports events in the modern city of the twentieth century. *The International Journal of the History of Sport*, *29*, 2050–2066. https://doi.org/10.1080/09523367.2012.719882

Ice Factor website. Retrieved from https://www.ice-factor.co.uk

iFly websites. Retrieved from https://www.iflyworld.co.uk and https://www.iflyworld.com and http://www.iflysales.com

ISS (2015). A complete history of the vertical wind tunnel. *Indoor Skydiving Source*. Retrieved from https://www.indoorskydivingsource.com/articles/a-complete-history-of-the-vertical-wind-tunnel

ISS (2016). Skydiving vs indoor skydiving – what's the difference? *Indoor Skydiving Source*. Retrieved from https://www.indoorskydivingsource.com/articles/skydiving-vs-indoor-skydiving-whats-the-difference

ISS (2019). Indoor skydiving locations (database). *Indoor Skydiving Source*. Retrieved from https://www.indoorskydivingsource.com/tunnels

Leich, J. (2001). *Chronology of snowmaking*. Cannon Mountain, NH: Museum Exhibit.

Marvin, S., & Rutherford, J. (2018). Controlled environments: An urban research agenda on microclimatic enclosure. *Urban Studies*, *55*, 1143–1162. https://doi.org/10.1177/0042098018758909

Massemin, E. (2016, December 16). Face au changement climatique, la station de Tignes veut mettre le ski sous cloche. *Reporterre, Le Quotidien De L'écologie*. Retrieved from https://reporterre.net/Face-au-changement-climatique-la-station-de-Tignes-veut-mettre-le-ski-sous

Press Tribune. (2016, October 8). Take flight: Roseville's skydiving mecca. *Press Tribune* (online). Retrieved from http://www.thepresstribune.com/article/8/10/16/take-flight-rosevilles-ifly-skydiving-mecca.

Ritzer, G. (1996). *The McDonaldization of society*. Thousand Oaks, CA: Pine Forge Press.

Scott, D., & McBoyle, G. (2007). Climate change adaptation in the ski industry. *Mitigation and Adaptation Strategies for Global Change*, *12*, 1411–1431. https://doi.org/10.1007/s11027-006-9071-4

Star, S. L. (1999). The ethnography of infrastructure. *American Behavioral Scientist*, *43*, 377–391. https://doi.org/10.1177/00027649921955326

Thrift, N. (2005). But malice aforethought: cities and the natural history of hatred. *Transactions of the Institute of British Geographers*, *30*, 133–150. https://doi.org/10.1111/j.1475-5661.2005.00157.x

Tivers, J. (1997). From artificiality to authenticity? The development of dry ski-slopes in England and Wales. *Area*, *29*, 344–356.

Tunnel Tech. (2019). Retrieved from https://tunneltech.eu/business

UIAA (2014). *Ice climbing complexes around the world help introduce sport to a wider audience*. Retrieved from https://www.theuiaa.org/ice-climbing/ice-climbing-complexes-around-the-world-help-introduce-sport-to-a-wider-audience

Vertical Chill website. Retrieved from https://www.vertical-chill.com

Walton, D. (2019). Life as a Red Devil…and the military's first serving iFLY wind tunnel instructor. *iFLY Blog*. Retrieved from https://www.iflyworld.co.uk/what-is-ifly/ifly-blog/instructing/the-first-serving-ifly-wind-tunnel-instructor-in-the-military

White, D., Rudy, A., & Gareau, B. (2016). *Environments, natures and social theory: Towards a critical hybridity*. London, UK: Palgrave.

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