

'The house' as a framing device for public engagement in STEM museums

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Abstract:

In the last five to ten years, several science, technology, engineering and medicine (STEM) museums have been experimenting with new forms of public engagement, aiming to be places for curiosity-driven investigation of the cultures of science via multiple perspectives, bringing artists, scientists, researchers, clinicians, members of the public and others together. Yet these diverse and rapidly evolving sites lack a clear definition of their family resemblances – something we argue is crucial for better understanding, advocating, and evaluating what they do. As a starting point for this definitional project we propose 'the house' as a metaphor and framing device for public engagement in STEM museums, grounded in experiences at Medical Museion in Denmark and Wellcome Collection in the UK. We further suggest that a Goldilocks principle – the notion of lying between two poles of a continuum in a 'just right' position – captures several key features of what it is about the idea of a house that resonates with the approach to public engagement in these museums.

Key words: STEM museums, science communication, public engagement, house.

Introduction

*In der Mitte aller Ferne
steht dies Haus,
drum hab es gerne.*

In the centre of all distance
stands this house,
that's why I love it.

(Hermann Broch, *Gedichte*, 1953, p. 68; English translation in Bollnow, 2011, p. 120)

The idea for this article grew out of a casual lunch conversation between the four authors. We were chatting about museums in general and the experiences of our institutions, Medical Museion in Copenhagen and London's Wellcome Collection, in particular. At some point during the conversation, the two native English speakers said they had both noticed, with a certain mild amusement, that Medical Museion's primarily Danish speaking staff often referred to their place of work as 'the house' (Danish: 'huse'). This vocabulary is used as a synonym for the museum, the institution, the building and the staff in discussions about its fabric, resources, employees, and multifarious activities. The Danish staff routinely spoke in terms of 'marketing the house', 'a strategy for the house', 'here in the house we believe', etc.

In an English language context, the primary connotation of a house is a private and homely place that serves as a dwelling for individual persons or a family. As evoked by the epigraph above, a house-as-home is an origin point for our forays into the wider world. In English to refer to the museum as a house thus sounds almost whimsical; it has a ring of intimacy and snugness¹ in apparent discord with its importance as a cultural heritage institution. Even

though the word 'house' is often part of the name of public and corporate premises such as a warehouse, light house, publishing house, or mad house, these sites are rarely referred to as 'the house' without the preceding modifier, and the noun is rarely applied to museums at all.

This pleausurably disjointed translation became the starting point for a longer discussion about the words we use to describe museums, and whether the notion of a 'house' might help to characterise recent developments at our institutions. The connotations of the word 'house' repeatedly drew our attention to the combination of a building and the people in it; to the relationship between the museum venue and the public engagement activities it hosts². It quickly became apparent that this framing was useful for rethinking what it is about our institutions' approaches to public engagement with science, technology, engineering, and medicine (STEM) that we would like to defend, and conversely, what it is that is problematic about how public engagement is currently understood and used to evaluate the activities of STEM museums.

Following the initial discussion, we developed the metaphor of the museum-as-house by iteratively comparing (a) common understandings of a house; (b) our experiences of our institutions; (c) concepts drawn from philosophical and sociological theory on houses, homes, and atmosphere; and (d) desires and disappointments within the public engagement literature, to derive a list of nine key 'house features'. This iterative process took place through discussion and writing; passing tentative features through our differing disciplinary perspectives to clarify a core rather than delineate neat boundaries. Our goal is neither to produce a complete theoretical framework, nor to provide empirical evidence for generic statements about visitor experience. Rather, and in the spirit of our institutions extending a curious, investigative attitude to everyone who passes through their doors, we take the research that comes from reflective 'living' in our houses seriously. We offer the result as inspiration, provocation, and potential prompt for both discussion and for narrower and more in-depth research projects.

Before describing the nine house features, we will lay some contextual and theoretical foundations. First, we summarize the discourse around public engagement with STEM that we want to challenge and extend. Second, we briefly describe our two institutions and the group of related venues that we see as having a 'family resemblance' in Wittgenstein's (1953) sense, and which we have drawn on in developing the museum-as-house metaphor. Finally, we lay out the concepts drawn selectively from philosophical and sociological theory on houses, homes, and atmosphere, that we have used in the iterative development outlined above.

What's the problem with public engagement?

Both practitioners and scholars of science communication are familiar with the well-worn shibboleth of a move from talking about public *understanding* of science and technology (PUS) to talking about public *engagement* with its practices, meanings, and implications (PEST). This move (and its many terminological variations) has been extensively analyzed elsewhere (see Irwin, 2009; Trench, 2008; Davies & Horst, 2016, Chapter 9). For our purposes it is enough to note that it was driven by both descriptive and normative critique of the ability of PUS activities to improve relationships between science and society (see e.g., Broks, 2004, Chapter 6; Bucchi, 2008). Of course, the definition of improvement is itself controversial; is the goal to improve public support for science or increase critical democratic involvement? To improve public knowledge for its own sake or to provide practical tools for life in a (bio) technological world? Regardless of motive, empirical studies have suggested both that it is hard to increase measurable scientific knowledge, and that increasing knowledge has unpredictable effects on public attitudes and political involvement (Bauer, 2008; Bell, 2010). Sociological studies of crises in science-society relations in the 1980s-90s revealed the extent to which contextual or lay knowledges were ignored, often with financial costs as well as damaging trust in scientific institutions (e.g., Irwin and Michael, 2003). These case studies have been mobilized to support arguments that greater 'engagement' is a democratic imperative; both normatively and pragmatically.

Against this background, arguments emerged for engaging public audiences and stakeholder groups in how science works – the material practices of experiment and the operations of theory; and in 'how science *really* works' (Durant, 1993) – the social, political, and economic contexts in which it is funded, evaluated, and ethically judged (Einsiedel,

2008). What this might actually mean in practice, and which societal and political processes were in fact open to greater public involvement, proved much harder to define. Critiques of public engagement activities such as consensus conferences argued that many paid only lip service to incorporating public perspectives, and failed to mend the frayed and woolly notion of public trust (Wilsdon and Willis, 2004; Horst, 2008). More conceptual analyses argued that these activities still bought into outdated models of 'science' and 'society', limiting their ability to challenge the structures of power and authority that prompted the move in the first place (Bell, 2010; Broks, 2004).

What comes next is unclear: the story of PUS to PEST has not yet settled on a conclusion. Suggestions include focusing on the materialities of science and science communication, echoing a wider material turn in the humanities (Davies 2014); focusing on style in science communication (Bucchi, 2013); co-curation (Boon, 2011) or citizen science (Lewenstein, 2004) approaches to building contexts for knowledge production not just contributing to them; and, as we argue here, starting from the messy cultural contexts where publics meet science rather than beginning from science on its own terms (Whiteley et al, 2017; Davies & Horst, 2016). Taking a slightly different tack, some recent empirical work has eschewed talk of engagement, favouring instead a broader concern with the landscape of 'informal learning' in a way that twists the traditional PUS concern with education to consider where, what, and how is learnt about and with STEM (Matterson and Holman, 2012). In the last year, commentators have also started to speculate about what the political upheavals of 2016 mean for public engagement; what engaging with science might mean in a world that seems only patchily interested in what experts say and think (e.g., Broks, 2017; Roche and Davis, 2017).

For STEM museums, these debates have been coloured by their status as repositories of material culture and as places to celebrate national or disciplinary achievements. These traditional imperatives might seem a natural fit to the PUS mould of communication. But we argue that STEM museums' focus on material evidence for scientific process and practice, and an eclectic tradition of display and collection practices, in fact provide potentially fertile ground for innovative engagement activities. This is not to neglect the specific challenges of communicating contemporary science via material objects, where invisible or massive scales offer few obviously appealing objects for display. Unlike the amputation saws or brass microscopes of the past, genetic sequencers appear as dull black boxes and the inner workings of big data software are intangible and invisible to most (Söderqvist, Bencard and Mordhorst, 2009). In addition, the social and political contexts of science can push museums into uncomfortably normative territory. Finally, inviting artists, sociologists, scientists, and publics to get involved in the museum's own (re)presentational practices, through for example participatory events or co-curation, comes up against pragmatic and professional barriers (Davies et al., 2015; Simon, 2010)

Which houses are we talking about and what do they do?

Our contribution to these ongoing debates about public engagement with STEM is to use the museum-as-house metaphor to draw attention to a new mode of using museums and related venues for public engagement. We aim to be relevant to STEM museums in general but draw primarily on intimate experience of our own two institutions, and on knowledge of and collaborations with a loose family of related institutions and projects, introduced in this section.

Domestic spaces have played a significant role in making science public since its very beginnings in early modern Europe. Not just a gesture towards inclusiveness, these were essential epistemological manoeuvres for a form of knowledge claiming universal relevance. Museums and curiosity cabinets were used as key pieces of equipment to ensure that science could be aired in public; exploiting and converting spaces that were private (or 'by invitation only') heralded the start of that process. These and other 'experimental chambers' provided half-way houses on the journey that scientific ideas and experiments took from private to public realms. This is a journey powerfully evoked in, for example, Joseph Wright of Derby's evocative 1768 painting 'An Experiment on a Bird in the Airpump', in which a family is gathered around a household table where a travelling lecturer holds them enthralled with a demonstration of a then-remarkable new piece of scientific equipment. More and more public outings using

a plethora of entertainment styles were developed throughout the following centuries, often hosted in increasingly elaborately furnished 'public houses'.

The two houses we work in are Medical Museion in Copenhagen (www.museion.ku.dk), which describes itself as a 'cross-disciplinary site for understanding medicine in historical, philosophical, and cultural terms' (Söderqvist and Pedersen, 2013) and Wellcome Collection in London (www.wellcomecollection.org), which is part of the major biomedical research charity the Wellcome Trust, and which declares itself to be 'a free destination for the incurably curious' (Arnold and Chaplin, 2013). Wellcome Collection is housed in the imposing building erected by the organisation's founder Henry Wellcome in 1932, which sits diagonally opposite London's frenetic Euston Station; while Medical Museion is housed in the late eighteenth century Danish Royal Academy of Surgeons buildings, complete with anatomical theatre.

Our two institutions aim to support curiosity-driven investigation of the cultures of science, technology, and medicine. And they aim to do so via multiple perspectives, bringing artists, scientists, researchers, clinicians, members of the public, and others together. This requires a more permissive than restrictive programming agenda: we aim for negotiated co-production rather than communicating topics defined within single disciplines³. Projects often therefore start from a particular experience or phenomenon related loosely to the human condition – such as obesity, concepts of the body, death, or the heart – and examine how it emerges within whichever knowledge cultures are represented in the curatorial and visitor group. Across these cultures runs an interest in process and practice rather than just promulgating results or beliefs. This approach embodies a type of informal learning that blurs the boundaries between traditionally authoritative institutions and experientially-driven co-creation. We feel that the engagement and understanding enabled in these settings is more likely to be 'lived with', rather than just banked, stored, or forgotten – and that this may result in more vibrant and meaningful engagements with STEM subjects than activities that begin from trying to translate the internal logics of STEM disciplines.

Drawing on a dispersed tradition of experimental exhibition making and on practices more usually found in art galleries, our houses also experiment with how their own venues, practices, and material culture can be opened up to new approaches. They play with size and duration, investigate relations between research and practice, and focus on integrating narrative and context with a serious attention to the material, affective, and sensory dimensions of topics and collections. This requires an openness to failure, and to exploring the messy back stage of the museum as well as the behind-the-scenes of science. The ideas that lie at the heart of the resulting projects are thus often somewhat contingent: showcased with an open acknowledgement of ambiguities, uncertainties, contradictions, and even plain mystery – the stuff of real life after all. Below we will argue that the features that *allow* for such an approach to public engagement and to the museum venue can be thought of in terms of what a house can provide.

A number of other institutions figured in our discussions, as sharing in aspects of our institutions' approach and thus as further inspiration for developing the metaphor⁴:

- The Deutsches Hygiene-Museum in Dresden, which provides an 'open forum for discussion, open to anyone who is interested in the cultural, social and scientific revolutions taking place in our society at the beginning of the twenty first century.';

Science Gallery in Dublin focused on 15–25 year olds, with a creative programme born out of the collision of art and science 'where today's white-hot scientific issues are thrashed out and you can have your say';

- The Berliner Medizinhistorisches Museum der Charité, which combines a permanent display that investigates the ever-changing historical view of the body 'beneath the skin' with temporary exhibitions on medicine and its history;
- Le Laboratoire in Paris and The Lab @ Harvard, contemporary art and design centers, where experiments by artists and designers 'at the frontiers of science' are exhibited as works-in-progress aiming at 'larger scale cultural humanitarian and commercial works';

- The Morbid Anatomy Museum in Brooklyn, New York, which was open from 2013 to 2016 and was 'dedicated to the celebration and exhibition of artifacts, histories and ideas which fall between the cracks of high and low culture, death and beauty, and disciplinary divides'.

There are also many individual projects that share some characteristics. A far from exhaustive list would include exhibitions staged at the Teylers Museum (see Bouquet, 2012 for a history) and Het Dolhuys psychiatry museum, both in Haarlem, and at the Museum Boerhaave in Leiden; initiatives hosted by Symbiotica in Perth and the Wet Lab in the School of Visual Arts in New York; the 'How the Light Gets In' festival at Hay in the UK and the 'Festivals of Ideas' held annually at the Serpentine Gallery in London; museums based in the houses and personal effects of historical figures, such as the Freud Museum in London, or fictional figures, such as Orhan Pamuk's Masumiyet Müzesi (Museum of Innocence) in Istanbul; and immersive theatrical and moving image productions produced by companies such as Punchdrunk and Secret Cinema.

What is a house anyway?

As outlined above, we began our discussion about the house metaphor from language as we use it. But in developing the list of nine key features, we wanted to pay attention to at least some of the extensive work that has been done on houses and homes from philosophical and sociological perspectives, and to iterate this against both our professional experience and the debates within public engagement that we hope to address. We focus on origins and definitions of the *house* and *household*, its relation to *home* and to the building's wider surroundings, and the concept of *atmosphere*. We further introduce key tensions between the connotations of permanent inhabitants and visitors; between inclusion and exclusion. And we explore tensions between feelings of comfort and excitement; between freedom to develop and the policing of behaviour.

House

Etymologically *house*, from Old English *hūs*, can be traced back to Proto-Germanic *hūsą* and *husan*, in today's German *Haus*, in Dutch *huis* and in Danish *hus* (Hoad, 1996). The word primarily refers to 'a building for people to live in, usually for one family' gathered around a household (from Greek *oikos*) (Phillips et al., 2010, p. 756), where a household is 'all the people living together in a house' (Longman Dictionary, 1987). In this sense, a house is a house of somebody, as when speaking of, say, the House of Windsor.

A house, however, is not exclusively for families. There are store- and warehouses, opera houses, hen-, dog-, and farmhouses, doss-, dream- and madhouses, hot houses and lighthouses, warehouses, halfway houses and outhouses. The late German philosopher Otto Friedrich Bollnow put it this way:

When we speak here in a comprehensive way of the house, this of course does not have to be a house of one's own [*Eigenraum*] in the sense of the one-family house. [...] The essential thing is man's ability to dispose of a space of his own, which offers reliable protection against the rigours of the weather as well as the unwelcome approach of strangers.' (2011, 126).

According to Bollnow, the house must be considered the world's center (2011, 120), which defines and protects from the weather as well as from troubling social dilemmas and exertions. But houses are not just places of comfort and shelter. They are also places of excitement, conflict, development, and dreaming of what lies outside – perhaps precisely because they offer a secure grounding or retreat. It's important to remember that threats don't just come from outside; they can also lie within, in restrictions on who may remain and how they must behave in order to do so, whether in a conservative family home or communal squat.

Home

Architecturally the house frames a home, and in so doing it represents a practice of territorialization. A home is often a place where the boundary between public and private, as well as between inner and outer geographical space, are pulled up sharply (Bille and Sørensen, 2012, 87). Yet there is a felt dimension to the home that exceeds the boundaries of bricks, walls and doors (Bollnow, 2011, 17) - the street, neighbourhood, city, and even country can also be included (ibid., 126). Home, as anthropologist Mark Vacher puts it, is where the house and its inhabitants 'melt together' (2011). It is important to note that this process is not necessarily positive, freely chosen, or experienced similarly by all inhabitants. In using the house metaphor, there is a danger of implicitly prioritising the heteronormative family and its intimate relations; we intend rather to question who shapes the practices of our 'homes'.

In some contexts it is useful to distinguish between house and home, but here we make a virtue of quite the reverse. In considering the critical role of architecture in shaping both Medical Museion and Wellcome Collection, we think not just about technical design, but about the simultaneous spatial, sensorial, material, lived and felt qualities of inhabited architectural space. This echoes Heidegger's insistence that humans are always already part of their surroundings; that man is *being-in-the-world* as a dweller: 'Dwelling ... is *the basic character of Being*', thus '[o]nly if we are capable of dwelling, only then can we build' (Heidegger, 1971, 158). In developing the museum-as-house metaphor, we borrow this idea that dwelling allows us to build; to build museum-houses, events and other exhibition activities.

Atmosphere

All humans dwell, but *how* they dwell and feel at home is highly variable and difficult to articulate. Here, the concept of atmosphere can help. We talk of places having a particular atmosphere and expect others who have been there to know what we are talking about, even if the details of the experience vary. Philosopher Hermann Schmitz articulates this incompletely shared experience: 'Atmospheres are super-personal [überpersönliche], joint feelings [...], the 'mood bell' [die 'Stimmungsglocke'] that unites all present' (Schmitz, 1996, 53 [our translation]). Moods are shared feelings and spatially shared feelings are atmospheres. But atmospheres are not simply projected by people onto space; or determined by spatial aesthetics: they lie somewhere inbetween.

Philosopher Gernot Böhme describes atmosphere in terms of a multifaceted relationship between the aesthetic qualities of the material environment and affectively laden human experiences (Böhme, 2001, 46-58). Atmosphere is thus 'quasi-objective', oscillating between people and their sensuous surroundings (ibid., 47). This attempt to overcome the subject-object distinction may be conceptually unsatisfactory, but its thrust is useful for our discussion. When considering what is special about house-museums and the activities that take place there, the constituting 'and' of people *and* place; of things *and* experiences, is crucial.

The nine house features

Below we lay out nine house features that describe our two museums and their distinctive approach to both venue and to public engagement with STEM, and which the family of related institutions and projects listed above share in to some degree. This is presented as a 'family resemblance' (Wittgenstein 1953); it is not an analytic definition of all 'house-like' museums. This is appropriate to our goal, but also to our object of study; museum kinds are not fixed, but constructed in on-going, and largely tacit, negotiations between curators, audiences and analysts.

Each of the nine features is introduced in the metaphorical realm with a description of the relevant elements of a house as we understand it, informed by the conceptual toolbox of the previous section. We then discuss and exemplify how each feature connects to our two venues and to the kinds of public engagement that take place within them. A thread running throughout is the notion of a Goldilocks principle of balance between two ends of a continuum, defined on various dimensions and scales. In the children's story, Goldilocks lets herself into

the house of the three bears and after sampling each bear's domestic arrangements settles on the porridge that is not too salty or too sweet, and the bed and chair that are not too hard or too soft. In the house-museum, many of these trade-offs or 'sweet spots' point to the central tension outlined above between the security or comfort a house provides, and the daring and excitement this allows. Containers for curious experimentation must be safe but not too safe; daring and flexible but not too chaotic. Open to presumptuous little girls and others remixing the domestic status quo.

1. A house is a physical building with a fixed location

To start with the obvious, a house exists in the geographic realm: it has physical extension and a particular spatial location⁵. It has an address, enduring over time, and is recognised as somewhere that bills can be sent and inhabitants can be reached. For museums, the fixed title and postal address are accompanied by publicly declared opening times, permanent staff (a household perhaps), an identifiable budget, a legal identity and corresponding responsibilities.

All of this is not by definition essential to the curiosity-driven investigation of the culture of STEM that interests us. These activities do not require a permanent physical location, and could just as easily happen via roadshows, pub conversations, or online networks. The benefits and drawbacks of institutional public buildings in contrast to virtual or community spaces have been reviewed and argued over extensively elsewhere. Here, we note that a physical repository is pragmatically essential to the collection-based material encounters we use to engage visitors in the processes and practices of STEM. But in addition, many of these venues draw on the aesthetics and historical resonances of their buildings as an essential part of the experience of attending an exhibit or event. Science Gallery's suggestively floor-to-ceiling glass frontage onto a busy public road resonates with its goal of community co-curation, and the Berlin Museum of Medical History's embedding in a hospital complex provides a historical point of contrast to contemporary art interventions. At Medical Museum it is often claimed that the anatomical theatre or even the house itself is the collection's biggest object.

A fixed location and physical building can also support a safe container for experimentation; a place to which responsibility and a developing sense of identity can be attached. A building exudes seriousness, permanence and a sense of establishment (from Latin 'stabilis', firm). To return to the epigraph of this article, a house is a place of shelter 'in the centre of all distance' (Broch in Bolnow, 2011, 120); a place where people can dwell, and thus build (Heidegger, 1971, 158). The accumulated history of what has happened in these houses builds into an overall style, reputation, and disciplinary blend that is more than the sum of individual activities. This also encourages unexpected encounters, as visitors arrive on the strength of the institutional reputation, but often without knowing exactly what they will find or do.

All addresses, however, are not equal. The house-museums we consider are generally located in largish cities, on busy urban roads where guests can arrive straight off the street, rather than being set in a park or down a lane. This makes them relatively accessible, and despite some regulars, these are not local clubs but places where new connections and encounters occur. As such, they can be seen as part of an agglomeration of institutions under the rubric of a 'third space' (in addition to domestic homes and workplaces), which allow for increased mobility, connection, and learning (Bautista and Balsamo, 2011; Bhabha, 2004) – overlaying the concepts of house and home onto the notion of a 'third space' might be a productive provocation.

2. A house is of a medium, domestic scale

A house tends to be big enough to hold different moods and activities – different people doing different things that do not interfere with each other. It needs to accommodate nooks and crannies for exploration or hiding away, but should not be so big that you get lost: a place of recognition not alienation. It also tends to have different sub-spaces for different activities – bathrooms, kitchens, living rooms and bedrooms – whilst preserving an overall atmosphere. The museum houses we refer to instead have receptions, exhibition galleries, event spaces

and auditoriums, study spaces, private storage and administrative rooms; sometimes cafes and always toilets; but again they have a distinctive overarching atmosphere.

Though varying greatly, the houses we are considering adhere to a Goldilocks principle of being somewhere between too big and too small. They are larger than single-room apartments; more like substantial family homes, but certainly not at the scale of grand corporate hotels, which by analogy are what National Museums become. In short, they are middle-sized public spaces big enough to gather large groups and develop a public profile, but not on the labyrinthine scale of an Uffizi or Rijksmuseum, nor a Smithsonian or London Science Museum. And in terms of the work involved in programming they therefore operate as busy workshops rather than factories.

This question of scale maps directly onto both material and affective aspects of the kinds of activities that take place within these houses. Far from block-buster experiences showcased at national institutions, the exhibitions and events mounted within them are small enough for guests to have an intensive encounter with the curatorial experimentation they promote, often focusing on allowing visitors to get close to the objects presented in their ideas-led exhibitions and giving events an intimate and pervasively participatory flavour. The houses themselves are also small enough to be 'done' in one go; for the visitor to have a sense of an overall atmosphere approach reminiscent of feeling familiar with someone's home.

Interestingly, the rapidly growing success of Science Gallery and Wellcome Collection has not led to large-scale expansion of the Dublin or London sites. Rather, Science Gallery has spawned other middle-sized versions of itself, while Wellcome Collection's recent redevelopment has been used not just to offer more of the same fare to more people in more spaces, but rather to enable new forms of deeper and slower participatory programming and interdisciplinary residences. We would be loath to suggest an upper limit to the scale of these places – and recall that the felt size of a house-as-home is not necessarily concurrent with its Euclidean dimensions. Nonetheless, we propose that the notion of the house and its affordances can help to temper pushes towards either reduction or expansion.

3. A house cares about the relationships between people and things

A house and its household are difficult to imagine without material objects⁶. Cupboards and drawers are jammed with stuff that reveal a domestic history of use: family heirlooms, electronics, and disposable ephemera. Furniture, decorative touches and children's toys are suggestive of different attitudes and relationships amongst inhabitants. The people and things of the house are in constant interplay, generating atmosphere at their intersection. The extent to which houses and homes are full of things of course varies historically and across cultures, individuals, aesthetic preferences and economic and environmental circumstances. Yet across this diversity, the relation between people, things and architecture is a matter of personal and intimate care. Even mess can sometimes be functional, expressing the failure of an existing arrangement to facilitate a comfortable relation between people and things. The traditional sitting room where things are to be looked at but not touched is often felt to be the least homely room of the house – perhaps echoing the permanent displays of our house-museums.

Some museums are ostensibly houses *and* homes; museums based on the homes of famous individuals or households are a very common kind of historical museum. Yet the object-rich, intimate, interventional atmosphere of a house is arguably what is desired rather than currently achieved by the house-museums we are considering here. Whilst visitors often build relationships with favourite things over multiple visits, museum objects are inevitably often the family heirloom peered at on a glass shelf, rather than the worn footstool with a foot nestled in its perfectly shaped dent.

Why does this matter? We have alluded several times to the value of material culture for pursuing one of the key goals of public engagement with STEM: enabling encounters with the practices, processes, and behind-the-scenes of knowledge production. Moving beyond the *display* of material culture to offering material, multisensory, and sometimes hands-on *encounters* is, we believe, important to realizing the potential of these forms of engagement. Whilst re-creations and visitor-friendly experiments in science centres, festivals, and community spaces go some way to achieving this, the notion of the house again turns our attention to the

importance of authenticity: in the felt experience of atmosphere of home, the specificity of the thing as well as the person is key. And in communicating the cultures of STEM, objects used by practitioners or produced by individual artists can lend this effect (Whiteley et al., 2017).

There are of course good reasons that museums find it hard to behave like homely houses; they have an imperative to protect their collections. But given these practical barriers, our museums and others in the loose family list above are experimenting with multisensory activities that borrow from the tradition of the science centre or school laboratory, but with a more house-like atmosphere. For example, Medical Museion events such as 'It's Not What You Think' and 'Look Again'... have used photography, drawing, and careful touching to get closer to medical objects and appreciate how they act on and between us, rather than focusing just on what the object does and where it comes from. The hastily assembled 'An idiosyncratic A – Z of the Human Condition' presented at Wellcome Collection matched an eclectic range of easily accessible exhibits with a range of relaxed, participatory activities. And experimental display installations such as 'Metascent' at Medical Museion have worked on augmenting, evoking, or substituting sensory encounters that are not possible to achieve through sight alone. Like Science Gallery and Le Laboratoire, our events often use professional scientific equipment rather than simplified school experiments, providing a point of contact with the experiential aspects of cutting-edge research.

Again, the notion of the house as a safe container for experimentation is crucial here; moving towards the domestic allows for the loosening of curatorial strictures. But the authentic material encounters we try to promote acquire at least part of their excitement exactly from the precious and unique nature of the objects at stake. Perhaps here we encounter another Goldilocks principle; enhance intimate relations between your things and your guests – but not so much so that they forget there is something strange and special to the encounter. Encourage people to try out the furniture, but inject a frisson of doubt that it can bear their weight.

4. A house invites you backstage

In contemporary private homes, the separation between public and private is usually blurred. Even though dinner guests are often welcomed by our positive selves in vacuumed and orderly surroundings, a peek behind the closed doors or too many glasses of wine easily disclose a more private, messy and homely universe. Visiting a home always invites the possibility of seeing the household in-the-making. On the other hand, museums usually restrict themselves to displaying a finished façade.

Many museums allow colleagues in the museum world to visit their conservation labs, planning seminars, and exhibitions in early stages of preparations, but general visitors are referred to the finished public exhibits with their immaculately conserved artefacts, polished design, and well-written texts. To borrow a well-known notion from science and technology studies, museums are not only presenting science as a 'ready-made' phenomenon (Latour, 1988), but also give the impression that exhibitions are themselves ready-made. In terms of Erving Goffman's dramaturgical analysis, museums are primarily operating in a 'frontstage' mode (1956, 78). Or in terms of Wilsdon and Willis' critique of public engagement as needing to move 'upstream' of the finished and thus unchallengeable products of science, museums are presenting the downstream results of the curatorial process. They should perhaps instead 'dismantle the proscenium arch and begin performing in the round' (Wilsdon and Willis, 2004, 24).

The notion of the museum-as-house thus gestures at the possibility of opening up the back stage to the general public, relinquishing the worry that this will destroy the magic of the resulting show. At Medical Museion, social media have been used to share the secrets behind the magic trick; showing photographs and film from the conservation of objects and the build up of exhibitions via e.g., Facebook, Instagram, and Twitter. And research publications analyse the curatorial processes and display strategies from an internal perspective (e.g., Davies et al., 2015; Whiteley et al, 2017). At Wellcome Collection, experimental projects in Gallery 2, such as the Institute of Sexology, evolve in public, during a year-long showing.

Ultimately, if one takes seriously the idea that showing the processes of science, technology, and medicine are crucial for public engagement with their functioning and meanings, it is inconsistent to present the museum or other public institution itself as an inviolable knowledge

producer. And if one is serious about participation and co-curation, a finished façade is like the proverbial brick wall.

Yet there is also a danger here: many curators are wary of inviting critique too early. They are also often reluctant to be too self-referential or 'naval gazing', and indeed exhibits that focus primarily on science-in-process or take a meta-level perspective on the museum itself have not always been wildly successful. In part, we would suggest this is a novelty effect. In a domestic setting we are very practiced at reading what the arrangement of things tells us about the relationships people have to them: in a museum setting, visitors need some help to 'read' the processes of arrangement or curation, and explicit invitations behind the scenes either in person or via online media are a crucial tool for familiarization. But it's also important to acknowledge that people do not come to museums primarily to find out how they are made; glimpses backstage are only interesting as long as the show goes on. Goldilocks is back on the scene.

5. A house has a distinctive atmosphere

Houses have distinctive atmospheres which are often sensed the moment one enters the door. A complex impression is formed by the interplay of architectural design, smells, lightness, darkness, colours, sounds, movements, temperatures, etc. The atmosphere literally floats in the air rather than sticking to the walls and furniture. We often have powerful memories of the 'feel' of a childhood friend's bedroom or grandparent's house. Such memories are often recalled through smell; the smell of a specific brand of laundry detergent can act as a *mémoire involuntaire*, triggering memories of an idiosyncratic constellation of 'things' previously experienced together with this specific scent. We all feel atmospheres differently, but within shared culture overlaps allow us to agree upon characteristic features (Böhme, 2001, 47).

Similarly, in the museum our diverse visitors experience different atmospheres, yet we would argue that there is some degree of constancy across people, and across visits. We suggest this relates to the house-like qualities of our institutions, and is another instantiation of a Goldilocks principle. Unlike a white cube gallery, which draws a minimum of attention away from the works on display, our two institutions have distinctive and pervasive architectural and decorative features. At Medical Museion there are nooks and corners, dusty attics, paved basements and wide floor planks creakingly giving way beneath the feet. There are heavy doors with brass handles, windows with glazed bars, stucco and high ceilings, and rows of hooks where surgery students hung their coats. Wellcome Collection also relishes its architectural features and allows them to be visible across its different spaces. It is grander than Medical Museion, constructed out of materials calculated to make a certain institutional impression: marble, brass and heavy doors. A series of more recent refurbishments have grappled with this, attempting to add transparency through large glass windows and doors and to soften the interior spaces with wooden floors and lighting that create pockets of more intimate space. Within this continuity, our museum-houses host exhibitions with different feels; our openness to co-curation could also be expressed in terms of accepting some uncertainty over what kinds of atmospheres will be created.

As with having a building and fixed address (feature 1), having a distinctive atmosphere is a crucial part of being a destination that can build up a reputation, and thus serve as a safe container for curiosity-driven experimentation. But not all atmospheres are equal; in the next feature we expand on the kind of atmosphere that house-museums encourage, and how this supports openness to experience and co-discovery.

6. A house is a place where guests feel welcome – but not too welcome

When guests are invited to our private houses, we generally want them to feel welcome and comfortable, to feel 'at home'. But in truth, we do not want them to feel too much at home – and not just because we want them eventually to leave. The excitement of having guests is in part about meeting the meeting of different perspectives. Vacher writes that it is precisely when the environment becomes familiar and lacks elements of surprise and unfamiliarity that a house becomes a home (Vacher, 2011); or in other words when habitual knowledge – what

Alfred Schütz calls *Gewohnheitswissen* (Schütz 1975, 191) – is prevalent. We do not want this for our museum guests, and arguably even amongst the staff, too homely a house can become cloying and dull.

This Goldilocks tension is again crucial for facilitating curiosity-driven exploration of STEM. We want our visitors to feel at home enough to try something new, but this very daring would be threatened by too homely an atmosphere. We want to introduce our guests to something they did not already know; to surprise; for them to feel richer when leaving our houses. To cultivate the atmosphere of a house without ever quite becoming a home – opening hours are one crude signal of the limitations of the invitation. Heidegger's concept of *Gelassenheit*, often translated as 'releasement' (see Heidegger, 2010), can help articulate this particular Goldilocks desire. *Gelassenheit* is a state of patiently awaiting; letting things appear (Heidegger, 1959, 27). One expects, but does not expect anything in particular, preserving the mystery and excitement of the still-unknown aspects of the world; a kind of daydreaming.

One way to tune the balance between guidance and freedom is through interactions with museum staff. At Wellcome Collection, highly-trained Visitor Experience Assistants (wearing bold 'Ask Me' t-shirts, but still mindful not to be too intrusive) offer an opportunity to find out more through conversation with an expert. While at Medical Museion, many guests visit the house on guided tours which offer an informal way of gaining digested knowledge whilst also being able to offer their own experiences and perspectives to an informal conversation. Far from being an out-of-date relic of museums past, such tours can offer a momentary, modest cosmos in the incalculable space of life; they offer suggestions for what visitors might take away whilst also facilitating leaps into the unknown.

7. A house contains a household that balances negotiation with authority

A house is home to multiple ways of doing things, and thus to habits of exchange and mutual respect. To live together well – to run a household – requires responsiveness to differing priorities and preferences; for cleaning, tidying, decorating, cooking, sharing troubles, or adjusting the volume on the T.V. Yet without some systems of authority and hierarchy of expertise, the washing up does not get done.

Many of the museums in our loose family engage in negotiations about how to 'live together', whether between members of temporary curatorial teams, between permanent staff whose roles often overlap and exceed traditional museum categories, or between staff and visitors. Collaborative work also raises difficult questions about authorship and ownership, which resonate all the way down to the many small, pragmatic decisions involved in producing an exhibit or event. These challenges are stronger for institutions that engage in multidisciplinary and participatory practices, and thus also have to negotiate between different epistemologies. We argue that this kind of approach is essential to curiosity-driven exploration, and that thinking of a household (rather than a management structure) can sensitise us towards what is required.

Moving towards more domestic habits of negotiation and mutual respect does not negate the need for authority, hierarchies of expertise, responsibility, and decision-making power. These structures fulfil practical functions, but thinking of them in terms of a household also introduces another facet of the Goldilocks principle: in nurturing curiosity-driven exploration we need visitors to feel a stake in our houses, but cannot relinquish all control. Indeed, the projects in our loose family unapologetically champion the role of expertise, very widely defined. They often have a 'head of the household', whose role can perhaps be thought of more as a *mater/pater familias* than as a neoliberal manager. But expertise also includes the people who get involved in production, whether they be doctor, dancer, scientist, patient, or scholar. It also includes the expertise of the staff, who mediate between houseguests and the enduring residents, rules, and atmospheric goals of the institution. The house also expresses a kind of 'meta-expertise' in curating relations between a cacophony of experts, making connections that might not otherwise have arisen. This is not a nuclear family; it is a shifting and sometimes chaotic band more like a thoroughly modern 'chosen family'.

As an example of an event that both invited multiple forms of expertise to explore a theme together, and which borrowed from the practices of negotiating within a family household, guests at Medical Museion's 'The Substance of Fat' event shared cake and conversation with a

metabolic researcher. The conversation encompassed questions about the relevance of research to participants' lives alongside a fascination with the technical details of how particular things can be discovered, and the scientist expressed pleasure in having had to situate his work in this field of meaning. In a typical 'Friday Late' at Wellcome Collection topics such as mistakes, the voice, coffee or hair are explored in vigorously different ways by different experts, all of whom shed light on the subject from their partial viewpoints, producing a perhaps chaotic but illuminating glow. At the event on hair, specialist demonstrations from the Handlebar Moustache Club of Great Britain, animal coiffeurs, biologists and experts in Victorian death/memorial-art gave insights into the materiality and cultural significance of hair, while interactive encounters including spinning, knitting, shaving, styling, waxing and microscopic analysis allowed visitors to investigate for themselves our multiple hair-obsessions.

8. A house is a process of gradual maintenance, repair, and rebuilding

Though they can be bought and sold, ultimately houses are made. Even once owned, we work on them, usually gradually. As the inhabitants grow, change jobs, become sick, and introduce new inhabitants into the mix, renovations follow. We paint a room, put up pictures, and take them down again. A show home is never homely. Similarly, the museum household includes a shifting mixture of builders, carpenters, and electricians; exhibition mounters or dismantlers; and continual dreaming about redecoration. Any activity requires a degree of 'redoing' the house. Thus the fabric of the building learns to accommodate the activities of its inhabitants, and the atmosphere evolves over time.

But the history of the projects and institutions we are discussing here echoes on a deeper level the often-quirky path of working on a house, rather than a discrete construction project with a clear brief. Their current agendas have often emerged from a littering of one-off, experimental and somewhat ad-hoc projects, which were gradually developed under an institutional context. A style and perhaps ethos of engagement is built in dialogue with a material practice that expresses it, but not all in one go. Rather, it emerges through the tinkering of daily and sustained use.

This tinkering approach to building a house has some interesting resonances with hacking and do-it-yourself practices. The exact definition and extension of 'hack' is the subject of heated debate, and refers to activities as diverse as citizen biology, adjusting shop-bought furniture, electronic engineering projects, and homebrewed beer. But for our purposes, hacking's attention to the domestic sphere, intervention in everyday practices and goods that we are often alienated from, and experimentation with possible matches between what you want to do and what is available to you echo the goals of gradual repurposing of traditional museum architectures and approaches. The analogy to hacking also implies inviting people from outside traditional scientific institutions to investigate scientific practice, resonating with the house-museum's goal of rendering the processes, practices, and politics of STEM itself open to intervention.

Yet, as with the notion of an intimately domestic relationship to objects, or inviting guests to act as household experts, extending the hacker attitude is perhaps more a desired goal than something that is currently achieved – and perhaps necessarily so. In a recent article on Medical Museion's 'Biohacking: Do It Yourself!' project, it was suggested that this practice should be extended in order to '... inspire us to hack the museum' (Davies et al., 2015; Tybjerg & Whiteley, 2013). But there are limits to how far the hacker ethos can be translated into museums, and hackers themselves are sceptical of the possibilities of genuinely enacting their forms of community within traditional institutions. At Wellcome Collection, the new Reading Room allows for more open-ended and fluid approaches to programming, allowing for pop-up events. But interestingly, even here much time has been spent on anticipating what public behaviours to encourage and what to

dissuade. Predictably then, we find ourselves back to the Goldilocks theme: a push towards openness and multiplicity within the constraints that enable it to proceed.

9. A house is a platform for life

Houses nurture and sustain, provoke and challenge. But they always do so in relation to a world outside. 'Man will step out into wide-open spaces if he is not held back' (Bollnow, 1961, 35). It provokes sadness to think of those unable to leave their homes. As described above, a house is a platform for life. In its flows and habits, and in the gradual development of intimate relations between people and things, the house/home points both to the past and to future desires defined in relation to these roots. As Bollnow implies, going home allows us to later leave⁷.

In utopian mood, most in our loose family would say that they aim to provide experience, learning, or creation which then effects change in the visitor's wider world. This aim is of course shared with traditional museums and science centres, but the *kinds* of effects we desire differ. As our house-museums move away from a primary emphasis on education and information transmitted 'in house', they acknowledge more temporally diluted and indirect effects dispersed across different contexts of life. For example, generating curiosity to explore a topic further, giving people the confidence to pursue a creative practice, or making subtle changes in their relations to health and healthcare – though over-stating these possibilities is one of the key pitfalls of public engagement rhetoric. Our house-museums aim perhaps primarily to sensitize visitors to the entangled presence of STEM in themes of life they already have stakes in.

In Florida's (2002) notion of a 'creative class', a blurring of work and leisure through forms of creative practice, and the recreational appeal of spaces that involve exchanges between these spheres in processes of informal learning, fits well with house-museums. Our institutions aim to be a platform for the experimental development of forms which, if successful, can be enacted by other institutions and groups. This process can be an uncomfortable one: experimental forms are often diluted and disciplined when applied more widely. Though, on Goldilocks' other hand, this letting go can also allow elements of experimental forms to be integrated with more radically bottom-up forms of 'hacking' STEM that are hard to support within houses with fixed addresses, structures of authority, and distinct atmospheres.

A house is a repository of the past and of the habits that sustain and define, but it is also a site of desire(s) for the future – think of a teenager fiercely dreaming about elsewhere surrounded by the material evidence of their growing up. The relation between past, present, and future is indeed an explicit concern of most house-museums. And even those members of our loose family without historical collections often aim in some sense to prepare us for the future by contextualising the present and its gestures into the unknown. This could come from the contingency revealed by history, from multiple disciplinary and participatory perspectives, or from explicitly speculative art and design practices (e.g., Auger, 2013). Our house-museums aim to be part of transformative conversations, rather than simply facilitating the pleasures of admiring things past.

Conclusion

In this paper, we have developed the metaphor of the museum-as-house in order to describe what we think is particular about our and related projects' approach to their venues and activities. The metaphor has also had a normative slant, describing the kind of public engagement we want to advocate: curiosity-driven exploration by collaborative groups, of themes relevant to life, and which *involve* STEM rather than beginning from a particular domain of scientific knowledge that the audience should engage with. One consequence of this approach is that the ideas that lie at the heart of exhibits or events are often somewhat contingent and unembarrassed about uncertainty, relaxing both curatorial and epistemological authority. Under the current cloud of anxiety about widespread acceptance of 'alternative facts' we are unmoved in our belief that transparency about process and context are crucial; in part because they are unavoidable. Perhaps the notion of a house/home – where it's hard to keep secrets and where the later discovery of dishonesty can be shattering to the household – can help us think about the careful balancing of honesty and contextual circumspection.

We suggest that the approach to public engagement we are advocating can be facilitated by being 'house like', where 'house' refers to the blend of the architectural, material, personal, and atmospheric qualities that make a house a home. Drawing on our intimate experience of our museums and a loose family of related projects, and informed by the literature on public engagement and selected sociological and philosophical treatments of key concepts such as 'house', 'home', and 'atmosphere', we have developed a set of nine house features. Of course many of these features are true of museums that are not house-like, and many projects that share in the approach we are interested in are not well characterised by all of these features. However, we argue that taking them as a whole, they identify something particular about the house-like approach to public engagement we are advocating. And further, that the juxtaposition of the domestic and institutional is a perhaps useful provocation in the face of more instrumental and managerial approaches to public engagement with STEM.

One of the overarching themes across the nine features is a 'Goldilocks principle' that suggests a balance between two ends of a continuum, where the dimensions in question range from physical size to degree of authority, and where both poles typically have positive and negative characteristics. Perhaps the central example, one which ties together some of the more pragmatic continua, is the aim to be a container for daring – to provide just enough safety to allow for experimental programming, curation, and unexpected experiences for everyone participating in the museum's activities. We discussed this in terms of the desire to cultivate an openness or 'gelassen' attitude that would facilitate daydreaming (feature 6; Heidegger, 1959, 27), and characterized by the fundamental tension between a house as a place of security and protection – 'in the centre of all distance' (Broch in Bolnow, 2011, p. 120) – and as a place of development and sensitization to the world outside (feature 9).

More pragmatic Goldilocks principles that contribute to cultivating this approach include that the house is of a medium scale (feature 2): small enough to allow for a strong anchor for overall identity and for a sense of intimacy, but large enough for smaller sub-exhibitions, atmospheres, and experiments to be cultivated within it. A house also invites you backstage to see the making of the household (feature 4), a feature we argue is crucial for nurturing a 'behind the scenes' attitude to STEM by 'walking the walk' with regard to our own practices. But of course houses still tidy up for their guests and exhibitions need to be appealing and avoid becoming lost in meta-reflection. A balance between being open vs. putting on a show was also explored in terms of cultivating a more domestic relationship between the arrangement of things and people, whilst still protecting delicate collections and preserving their potent and unfamiliar preciousness (feature 3). And when adding exhibition and museum architecture to the blend of things and people, we argued that celebrating a process of gradual construction and renovation in the manner of a domestic house helps to 'stretch' often resistant traditions of curatorial practice (feature 8).

All of these principles involve disturbances in traditional roles and structures of authority; within the museum; between the museum and its visitors; and between scientific and other forms of knowledge. We discussed therefore the idea of a household social structure built on mutual respect and negotiation but retaining respect for expertise and (non-authoritarian) authority (feature 7). This accumulation of facets, practices and habits ends up being discerned in the feature that is perhaps hardest to pin down, that distinctive atmosphere that might better be found through the nose than the intellect and described in gestures rather than words (feature 5).

To conclude, we take the liberty of reframing the house features as prescriptive advice for being more house-like: love your venue and nurture its distinctive atmosphere; do not expand too much and make space for small experiments and sub-atmospheres, for constant renovation and whimsical redecoration projects; think about museum objects with a domestic sensibility, allowing them to enter into intimate relationships with your visitors; do not tidy up your processes too much and sometimes wear them on your sleeves; invite diverse publics and experts into a household negotiation; make your visitors feel safe and at home – but not too safe for excitement; and treat STEM as one guest amongst many in exploring ways of living together.

Notes

- 1 No romanticization intended; see also feature 7 where we discuss the limits and possible oppressions of intimacy in relation to the notion of a family-based household.
- 2 This dual focus on place and activity resonates with arguments for studying public engagement with science as a material and affective practice, not just a discursive activity (Davies, 2014).
- 3 An approach that is echoed in the production of this paper, which draws on the interests and insights of four authors with quite different backgrounds. As such we do not aim to offer a complete analysis from any one disciplinary perspective but rather present what emerges from their intersection.
- 4 We list these institutions to give a richer sense of the landscape at stake, but do not pretend to be comprehensive or particularly rigorous in our selection. Neither do we intend to suggest that they share a delineable essence; they are as striking in their differences as in their similarities and we therefore draw on Wittgenstein's (1953) notion of a practically useful 'family resemblance' in gathering them together.
- 5 Here, we use the terms *space* and *place* in colloquial, everyday terms, but recognise the scholarship that surrounds both and questions surrounding e.g., the possibility of defining place independently of the emplacement of persons (e.g. Augé 1995; Casey 1997; Kahn 1996; and Pocock 2006)
- 6 Here again we are in the realms of contested terminology. From a standard curatorial perspective, one would refer to museum 'objects' or 'artefacts'. But from a phenomenological perspective, these terms can imply the fixing and prioritisation of meaning over a focus on materiality and sensation – the latter aspects we are arguing are key for engaging with the processes and practices of STEM. We might therefore prefer to talk instead of 'things' or 'stuff', but here we will mix terms as appropriate to the context.
- 7 In examining this feature, we purposefully set aside the fact that the boundaries between home and work are increasingly blurred by computing and the internet, assuming that both the platform of the house and the world outside involve complex mixtures of 'work' and 'life' (cf. Florida, 2002).

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Acknowledgements

The authors would like to acknowledge ongoing discussions with colleagues at Wellcome Collection and Medical Museion, particularly the evolving discussions in Medical Museion's seminar series.

Funding Acknowledgement

This work was supported by the Novo Nordisk Foundation through the Section of Science Communication, NNF Center for Basic Metabolic Research, University of Copenhagen (Principal Investigator: Thomas Söderqvist).

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