# *Function and forethought in design*

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*The function or intended use of a device such as a fire escape is escape from fire, whether or not it is ever actually used as such or it acquires other uses. Biological function, on the other hand, depends, in one way or another, on actual use. Philosophical attempts to explain artifact function by analogy with biological function or to build a unified theory of function are nonetheless common. What such attempts routinely overlook, however, is the role of forethought in intentional function. I defend the traditional intended use view of function, emphasize the role of forethought and argue that design intentions are rationally grounded in a design brief, for which there is no obvious natural analogue.*
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Many philosophers have emphasised the 'mind-dependence' of artifacts and their functions (Neander, 1991, 2017; Baker, 2009; Kroes, 2002; McLaughlin, 2001; Searle, 1995).[1] Karen Neander (1991), for example, does so when she defines the function of an artifact as "the purpose or end for which it was designed, made, or (minimally) put in place or retained by an agent" (p. 462). Similarly, The Oxford English Dictionary [OED] (2017) defines function (in this sense) as a "mode of operation that is proper" to a thing, its "purpose or intended role" (function, *n.* 2a).[2] The OED (2017) then goes on to define biological function as a "specific action" or "activity" that is "special, normal, or proper to an organ or other part of the body of a living organism" (function, *n.* 2b. *Biology*). This indicates that we ordinarily think of biological function as being similar to artifact function, minus any dependence on purpose or intention.

Two questions arise: what difference does 'mind-dependence' make in respect of artifact function and what, if anything, replaces it in biological function? A common answer to the *second* question has been to say that the traits or parts of organisms acquire their functions by the process of evolution by natural selection (Parsons, 2016, p. 92). In turn, this process has served as the source of an analogy with *artifact* function, which bears directly on how several authors have chosen to answer the *first* question above. Paul Griffiths (1993), for

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example, says that an evolutionary account of biological function "can be extended to artifacts because human selection does for artifacts what natural selection does for organisms" (p. 419). But extending the evolutionary account of function from biology to culture has turned out to be more difficult than first seemed. Consider the following examples of such difficulties.

First, Griffiths (1993) agrees with Neander that the proper function of an artifact is its intended use, but he adds that this is so "only because its ability to fulfill its intended use gives it a propensity to be reproduced" (p. 420). This is the link with biology. But why should an artifact that satisfies its intended use have a propensity to be reproduced? Why should others share the intentions of the original designer or maker? Moreover, many artifacts are simply not *meant* to be reproduced or copied, whether or not they fulfill their intended use, for example, the Sydney Opera House.

A second example of the problem with the biological or evolutionary analogy is the following argument by Beth Preston (1998):

> In biology, if the new trait or use of a trait is successful in its performance, and its success contributes to the reproductive success of its possessor, it thereby ensures its own reproduction as well. Similarly with artifacts, if the new artifact is successful it will be reproduced; … In the cultural milieu, this history of reproduction contingent upon success shows up as a history of manufacture and distribution by trade or sale. (p. 244).

An artifact may fail to be reproduced, however, *in spite of* its apparent success. A safe injecting facility for illicit drug users, for example, may save lives and yet be prevented from being replicated, which has been the case with Australia's only established facility, in operation in Sydney for the past two decades (Wodak, 2016; Department of Health and Human Services, 2020; Gstrein, 2019, p. 111).[3] Conversely, an artifact may be reproduced in spite of its apparent *failure*. For example, Nikolaus Wachsmann (1996) asks why "the constant failure of the prison to live up to its claims has had no impact on its continuing longevity" (p. 4). Penitentiaries flourished in the 19th century even though they were not, as Jeremy Bentham had imagined, "a mill for grinding rogues honest, and idle men industrious" (Bentham, 2018, c. Friday, 25 November 1791).

A third example is a proposal by Philip Kitcher (1993) that there is a "unity of conception" of function in artifacts and organisms, based on the concept of design (p. 379). Kitcher (1993) says, "the function of X is what X is designed to do" (pp. 380, 383) and in the biological case "what X is designed to do is that for which X was selected" (p. 383). But what price now a unity of conception with artifacts? When Utzon won the design competition for the Sydney

Opera House his scheme was not the only one that had been designed (as an opera house) because it won.

In this paper, I defend the view that the function of an artifact is its intended use. The function of a fire escape, for example, is escape from fire, whether or not the escape is ever actually used as such or it acquires other uses. A central dilemma for the biological analogy, or for any unified account of function based on the analogy, is that unlike artifact function, biological function depends on actual use or effect. The wing-pattern of a moth, for example, has the function of camouflage only if camouflage is an actual effect of that pattern. In Section 1 below, I consider two important philosophical accounts of function (by Larry Wright and Ruth Millikan), which aim for unification. I then discuss two more recent attempts by philosophers (Françoise Longy and Beth Preston) to apply the biological analogy to artifacts. A general aim of this discussion is to bring out the neglect or misunderstanding of the role of intention and forethought in accounts of artifact function. In Section 2, I offer a case study of fire escapes and their regulation under a building code to amplify these points. In Section 3, I defend the view of artifact function as intended use/intended effect, indicating how a designer's intentions are (or can be) rationally grounded in the design brief. The role of the brief in the design and procurement of artifacts generally has been largely overlooked by philosophers, even in intentionalist accounts of function. Wybo Houkes and Pieter Vermaas (2004, 2007, 2010), for example, develop the idea of a use plan, which I argue is not up to this task. In Section 4, I conclude with a brief illustration of the central role of forethought in the function and design of artifacts.

# 1 Function, biological analogy and forethought

## 1.1 Larry Wright and Ruth Millikan

Larry Wright (1973) and Ruth Millikan (1984) are prominent philosophers of function, offering accounts designed to cover both organisms and artifacts (Parsons, 2016). Wright (1973) points out that function statements in biology and material culture have a "profoundly similar ring" (p. 143), for example, 'The function of spines on a porcupine is protection from predators' and 'The function of spikes on top of a gate is warding off intruders'. In each case, Wright (1976) would say, the function of the thing concerned is "that particular consequence of its being where it is which explains why it is there" (p. 78). Wright calls this pattern of explanation a 'consequence-etiology' (p. 73).[4] In a "merely causal" sequence, an item, X, causes an effect, Z; but in a consequence-etiology, Z causes Z (Wright, 1976, p. 57). Wright does not mean here that an effect causes itself but rather that, in the case of the porcupine's spines, for example, protection from predators is a consequence of the spines being there "and that is clearly why things with spines, and hence the spines themselves, have

survived" and continue to provide such protection (p. 91). In the artifact case, warding off intruders is what spikes on gates have done in the past, which led to their being reproduced in such locations and explains why providing such protection is their function (Buller, 1999, p. 12).

A general problem for Wright's account above, however, is that a consequence-etiology is *not* "the very same sort of etiology" in intentional and non-intentional cases (Wright, 1976, p. 84). Under natural selection, Wright (1976) says, "nothing is *doing* the selecting", but "given the nature of X, Z and the environment, X will *automatically* be selected". Under intentional selection, "the consequences are selection *criteria*. So we can say in these cases too that given X, Z and the environment, which includes the selection criteria, X will be selected automatically in just the same way" (p. 86). Wright gives the example, "I chose American Airlines because its five-across seating allows me to stretch out" (1973, p. 163; 1976, p. 85).[5] This seating arrangement can have the consequence Wright desires, however, only if the flight in question is not heavily booked, and so its selection is not 'automatic'.[6] It depends on a future assumption that the flight will not be crowded. Natural selection, on the other hand, does not exercise forethought (Neander, 1991, p. 460). The porcupine's spines are selected because of their past protective effect not because of an expectation they will be protective in the future. Rational selection, however, *depends* on forethought, as well as experience.

A common objection to Wright's account is that many artifacts are not the product of a consequence-etiology. An artifact that is the *first* of its kind, for example, the first reef knot or the first moon-landing vehicle, has no ancestor, but it still has a function (Millikan, 1984, p. 18; Neander, 1991, p. 462; Buller, 1999, p. 25; Vermaas & Houkes, 2003, p. 266; Parsons, 2016, p. 99). An artifact that is *one* of a kind or a *one-off*, such as the Sydney Opera House or George Orwell's *1984*, is not a reproduction and is not itself meant to be reproduced, but such artifacts still have functions (Neander, 1991, p. 462; Gracyk, 2012, p. 62; Kroes, 2012, p. 117).[7] Lastly, many artifact *types* seem to have functions they cannot fulfil (Griffiths, 1993, pp. 420–421; Vermaas & Houkes, 2003, p. 265; Baker, 2009; Preston, 2013, p. 177; Parsons, 2016, p. 97). In the biological case, dysfunction is confined to the unsuccessful tokens of otherwise successful types. The function of the heart is to pump blood only if some hearts have pumped blood or continue doing so, but in the case of artifacts failed types still seem to have identifiable functions. The penitentiary did not produce penitent souls (Guenther, 2013, p. 20), for example, and a perpetual motion machine cannot produce perpetual motion.

Turning to Ruth Millikan, she introduced the term, 'proper function', as a theoretical or technical term, but one which builds on the ordinary meaning of 'proper' evident in the OED (2017) definition of 'function' above. According to Millikan (1984): "Having a proper function is a matter of having been

'designed to' or of being 'supposed to' (impersonal) perform a certain function" (p. 17). The proper function of a thing is its "*own* function", not something "imposed on it or accidental to it" - and it is what I shall mean by 'function' unless otherwise indicated (Millikan, 1995, p. 31, note 1; see also Millikan, 1999, p. 192; Parsons, 2016, p. 87). The proper function of a screwdriver, for example, is turning screws, not opening tins of paint, which is an accidental or non-proper function many screwdrivers do perform. Proper functions can arise not just from designing or making, but from social agreement generally about the appropriate use, recognition or location of an artifact (Neander, 1991; Crowe, 2014).

According to Millikan (1984), the members of what she calls 'reproductively established families' have proper functions (pp. 18–19), and she distinguishes two kinds of proper function: direct and derived. In relation to tools, Millikan (1984) says:

> Tools that have been reproduced (as have traditional carpenter hand tools) because of their success in serving certain functions have these functions as *direct* proper functions. But all tools have as *derived* proper functions the functions that their designers intended for them (p. 49).

Taking direct proper function first, the intuition here is that a tool that is a reproduction of a successful ancestor inherits its proper function directly from that ancestor. As we have seen above, however, an artifact is not reproduced merely because of its past success in serving a certain function. Rationally, it is reproduced only because it is expected to be able to continue serving that function. Suppose the system of measurement in a country were about to change from imperial to metric, then the past success of an imperial carpenter's rule would not ensure its reproduction or prevent its replacement by a metric rule (or a rule which incorporated both systems). In biological evolution, reproduction is necessary for natural selection, but in material culture intentional selection is necessary for production, including reproduction. We *select* which artifacts to reproduce, and we do so in anticipation of their future utility not merely their past success. This fact raises a doubt about the explanatory status of direct proper functions, so far as artifacts are concerned. Indeed, Millikan (1984) soon adds that "tools simply *as such* have only *derived* proper functions" (p. 49).

If artifacts have proper functions derived from the intentions of their designers then on Millikan's (1984) account both novel artifacts and failed types of artifact have derived proper functions, that is, functions derived from the novel or mistaken intentions, respectively, of their designers.[8] In this way, Millikan can explain functional cases Wright was unable to account for. Even so, the burden of explanation still falls on *intentions*.

## Function and forethought

## 1.2 Françoise Longy and Beth Preston

In this section, I consider two, more recent accounts of artifact function based on the biological or evolutionary analogy. The first is by Françoise Longy (2009, 2013); the second by Beth Preston (1998, 2009, 2013) whose account we sampled above.

Beginning with Longy, she follows Neander (1991) and Millikan (1984) in holding that the function of a biological trait is a selected effect, which she refers to as a selected or SEL function (Longy, 2009, pp. 51–52). Longy then claims that biological SEL functions can be applied directly to some artifacts, namely *prototypes*, because of the process of testing a prototype undergoes. Longy (2009) says:

> [A] selected function refers to a real property (the effect that some Xs had, which led to the selection of Xs against variants), while an intended function refers to a mental content relative to the Xs (the effect that rational humans think some Xs, at least, will have in determined circumstances). Now the testing of prototypes has to do with real effects, not with imagined effects. (p. 63).

Contrary to Longy's view of testing, prototypes are tested in order to determine whether or not their *imagined* or *intended* effects *are* real effects; and so prototype testing has as much to do with intended effects as real effects. Longy (2009) gives the example of testing car-airbag trigger prototypes in a crash-test laboratory, from which one prototype, M12, emerges "victorious" and *thereby* acquires an SEL function (p. 63). There are several objections to this argument. The first is that a prototype for a novel artifact is *itself* a novel artifact, and so the problem of novelty recurs: where did the function of the *prototype* come from? Why test M12 unless M12 *already* has the function of a car-airbag trigger? A second objection is that although M12 may be victorious in the tests it may not in fact be selected. M6, say, may be preferred to M12 – perhaps because it is less fiddly or more reliable, or cheaper to install in vehicles under factory conditions.

Longy (2009) herself raises an objection to ascribing an SEL function to a prototype, one which derives from the gap between "real effects" in the laboratory and "*real-life* effects" (p. 64). Longy (2009) says this objection fails, however, because "if the test made is a good one, there is nothing against categorizing the effects relative to which the prototypes are tested as they would have been in the corresponding real-life situations" (p. 64). But the objection is not that an inference from laboratory effects to real-life effects may not be a good inference; the objection is that any inference is required at all. Longy's "real effects" occur now, in the laboratory; the "corresponding real-life situations" are to be found, if at all, in the future, beyond the laboratory - for that is

when M12 will be in use, if it is selected.[9] Under natural selection, selection occurs in real-life; there is no gap.

Glenn Parsons (2016) points out that an important "epistemological problem" (p. 35) in design is whether or not "a novel entity will function adequately in the world" and this is "not something we can know a priori" (p. 38). This is the kind of difficulty Longy faces above. Parsons (2016) suggests that craft does not face this problem because, unlike design, craft is tradition-based. A craftsperson can be assured an item will work because it is "the result of a long process of trial and error, during which minor alterations in the form have been made in response to problems, and tested by experience" (p. 36). But a basis in tradition does not eliminate the need for forethought. The craftsperson needs to decide whether or not the conditions under which an item will operate in future are relevantly similar to the past, and so the epistemological problem that confronts design is also present in craft, if in an attenuated form.

Turning finally in this section to Beth Preston, she endorses Millikan's direct proper function (as her sketch of the evolution of material culture above indicates) but she rejects Millikan's derived proper function, claiming that it arbitrarily privileges the designer's intentions over those of the user (Preston, 2003, p. 608; 2013, pp. 166–169). How then does Preston explain how artifacts without ancestors, successful or otherwise, still seem to have proper functions? How are novel artifacts or failed types of artifact to acquire proper functions, if not by way of the intentions of their designers or makers? Preston is forced to the conclusion that a novel artifact, having no direct proper function, has no proper function *at all* (Preston, 2003, p. 609; 2009, p. 49). Many have found this conclusion "deeply counter-intuitive" (Parsons, 2016, p. 99), including, not surprisingly, Millikan herself (1999, p. 205).

One argument Preston (2013) advances against the possibility of novel artifacts having proper functions is that perhaps we have come to mistakenly think they do, because "non-novel prototypes uncontroversially have proper functions" (p. 174). But a 'non-novel prototype' is a contradiction in terms. Designers build prototypes to test or evaluate *novel* ideas, otherwise what would be their point? To facilitate the application of (direct) proper function in design, Preston sets a *low* bar for reproduction, one which allows something to count as a copy even when it includes "minor changes" to the original (Preston, 2013, 174). And conversely, she sets a *high* bar for novelty, one which many novel artifacts would fail to clear. Preston (2013) takes the view that few things are novel because few things are *radically* novel. "Human inventiveness", she suggests, "consists in making incremental changes in existing types of items rather than producing radical novelty out of nowhere" (Preston, 2013, p. 157). So is Robert Hughes', *The Shock of the New* (1991), mistitled? The changes Hughes found in modern art and architecture were radical, but they were still changes out of *somewhere*, otherwise they would have lacked

intelligibility or relevance. Moreover, change can be radical in part *because* it is change out of somewhere. Abstract art was a shock when it first appeared largely because it was supposed to be *art*.

A further response by Preston to the problem of novelty has been to suggest that novel artifacts *do* have a function after all, a 'causal role' function (Cummins, 1975) or 'system function' (Preston, 2013, p. 165). The system function of an item is the causal contribution the item makes to the operation of the system of which it is a part, a contribution which derives from its *capacity* rather than its *history*. (This gets around the problem that novel artifacts have no ancestors.) If a heart surgeon keeps an artificial heart on her desk to explain to prospective patients how the device works then, in the system of patient care, the device has an educative function; its proper function would remain that of pumping blood. But can a system or causal role function do the work of a supposedly absent proper function? Preston (2013) considers a novel prototype can-opener:

> If it did indeed open cans, it succeeded in fulfilling a role in a containing cultural system involving food preservation and storage devices, including cans. Prototype can openers that work have the system function of opening cans, then, and prototype can openers that do not work simply have no system function. (p. 165).

If something *works*, however, then it has a function it fulfils. It is a *separate* matter whether or not it works in a particular system. The 'containing cultural system' here may grind to a halt not because the *can-openers* don't work but because the *cans* don't (perhaps the cans are easily dented out of shape). In which case, the can-openers would lose their system function, along with the cans, even though the can-openers still *work*. Preston's system function is thus propped up by an undeclared *intentional* function, which is implied in the idea of something *working*.

Turning to the second problem confronting Preston, the function of failed types, she (2013) now offers a revised definition of proper function, to include functions that an artifact is "constitutionally incapable of performing", which she calls 'phantom functions' (p. 177). Preston (2013) redefines 'proper function' in relation to artifacts as follows:

> A current token of an item of material culture has the proper function of producing an effect of a given type just in case producing this effect (whether it actually does so or not) contributes to the best explanation of the patterns of use to which past tokens of this type of item have been put, and which in turn have contributed to the reproduction of such items. (p. 187).

Does this move succeed? Topical lotions for male baldness were once popular even though they failed to promote hair-growth. Failing to promote hair-growth was thus a phantom function of the lotions. But *not* having the effect of promoting hair growth does not explain why the lotions were used or reproduced to *promote* hair growth. The lotions did not make men slimmer or taller either, but these similarly non-existent effects were not phantom functions because the lotions were not used or reproduced (or originally made or advertised) with *these* effects in mind, that is, they were not the *intended* effects or *intended* functions. As with system function, Preston's phantom function needs to be propped up by intentional function.

Given the existence of phantom functions, Preston (2013) now says that the proper functions of artifacts derive from "historical patterns of actual use and reproduction for that use" (p. 11; see also Preston, 2009, p. 48; 2018, p. 11; Vardouli, 2015). This is the actual use view of artifact function, which I examine in some detail next.

## 2 *The actual use view of artifact function*

On the actual use view of artifact function, we almost come full circle. If Darwin's 'greatest discovery' was that there is design in nature *without* a designer (Ayala, 2007, p. 55; Kitcher, 1993, p. 380), we now find that, on the biological analogy, there is little or no role for the long-suffering designer in how *artifacts* get their functions! Preston (2013) claims it is a recent and parochial Western conceit to think otherwise. Go back to Plato or Aristotle, she suggests, and you find "the designer's role is, in effect, just an aspect of the user's role, and not a separate activity or capacity at all" (p. 173).[10] Plato (1974) is quoted saying:

> It's wholly necessary, therefore, that a user of each thing has most experience of it and that he tell a maker which of his products performs well or badly in actual use. A flute-player, for example, tells a flute-maker about the flutes that respond well in actual playing and prescribes what kind of flutes he is to make, while the maker follows his instructions. (p. 173).

But how helpful is Plato here when he does not recognize the activity of design? And why allocate the task of design, if we do recognize it, to the user rather than the maker? As for Preston's suggestion that design is part of the *user's* role, there are many occasions when the designer simply cannot be the user, and vice versa. Men design clothes for women they cannot wear themselves as women and babies cannot design anything they use or need themselves. Preston (2013) now says: "Every user is potentially a designer, in virtue of the kind of knowledge involved in use" (p. 173). But my knowing how to cross Sydney Harbour using the bridge or how to send an email from my ipad does little to equip me to design bridges or computer software.

To better understand the relations between design, function and use, let us consider the fire escape and its regulation under a building code.

## 2.1 Fire escapes and building codes

In 19th century New York, tenement houses were firetraps. In 1860, New York City introduced regulations covering large tenements which required, in the absence of a "fireproof" internal stair, a dedicated structure of "fireproof balconies on each story on the outside of the building, connected by fireproof stairs" (Wermiel, 2003, p. 260). This external structure came to be known as a fire escape (Wermiel, 2003, pp. 261, 266). The escapes were often difficult or impossible to use, however - poorly built, flammable, discontinuous or blocked. They were attached to the facades of tenements and so would-be escapees were typically exposed to fire in any apartment on the way down. A survey in one Brooklyn ward in 1900 found that most tenements had no fire escape or nothing more than a precarious arrangement of ladders (Bonner and Veiller, 1900, pp. 11–14). Not surprisingly, "Fire department records from the 19th and early 20th centuries overflow with accounts of people unable or unwilling even to climb down a fire escape" (Shelhamer, 2010, p. 2; Wermiel, 2003, pp. 266–275). What many fire escapes *did* provide, however, was a welcome extension to typically cramped tenements. The escapes were used for household storage, drying washing, airing bedding, sleeping-out and home-based industries, all of which uses further compromised their escape function (Bonner and Veiller, 1900, pp. 8–9, 14–20; Dwork, 1981, pp. 17, 24; Dolkart, 2007, pp. 30, 34–36, Wermiel, 2003, p. 274).

In 1862, New York City legislated for a narrow common door between adjoining front and rear apartments so as to enable the occupants of the apartment on one side of the building to reach the fire escape on the opposite side, if one were provided or operable. The architectural historian, Andrew Dolkart (2007), rates the chances of escape by this means as "negligible", however (p. 36). Households attached makeshift locks to the common door for security and the "tiny bedrooms" on either side of the door "contained so much furniture and bedding that it would have been exceedingly difficult to open the door in case of emergency" (p. 36).

To sum up, the external escape and the common door were often unused or unusable as escapes, but escape remained their proper function. Building regulation not actual use explains the introduction and proliferation of fire escapes in New York, and later other North American cities (Wermiel, 2003, pp. 263–265). External escapes acquired a variety of ordinary household uses, which compromised or negated their escape function, but they were reproduced for this function and not for their domestic uses. Police magistrates were reluctant to fine or imprison tenants for such misuse (Bonner and Veiller, 1900, p. 20), but the fact of this offence is evidence that the proper

function of the fire escape was escape from fire. In short, a fire escape is there only in case it is needed and it may never be needed, and hence never used as such.

Turning our attention now to building codes, how might a code or its operation be explained or understood on the actual use view of function? Take the Building Code of Australia (BCA). The BCA sets functional or performance requirements for buildings and their elements or features. These requirements can be satisfied in either of two ways (or a combination of both): firstly, by employing the relevant deemed-to-satisfy solution(s) in the Code, which we may call its prescriptive mode; and second, in the case of a novel feature or arrangement, by employing a "method of verification" - such as a "test, inspection, calculation, or other method", to show that the feature or arrangement in question satisfies the performance requirements of the Code (Australian Building Codes Board [ABCB], 2019, pp. 18, 665).

Take the following example. On the BCA's prescriptive mode, the minimum aggregate unobstructed width, W, of an exit or exits from an open spectator stand varies with the capacity of the stand (ABCB 2019). If the capacity of the stand is, say, 120 people, then W is 1.25 m; if its capacity is 280 people, then W is 3 m, and so on (ABCB 2019, p. 132).[11] But how would we arrive at such dimensions on the actual use view of function? Do we build spectator stands with these (and other) capacities, and exits of whatever widths, then wait for the stands to burn down when fully occupied, and be (safely) evacuated by their exits, in order to assign them functions? Even this unlikely chain of events would not be sufficient, however, because no such actual width of an exit may be safe minimum value. The BCA provides values for W for stands of all *possible* capacities, many of which may never have been or will ever be built. Functions are assigned to possible features of exits (heights, widths, distances to or between exits, number of exits, construction of exits, and so on) based on theoretical analysis, building simulation and testing, informed (or ill-informed) reasoning, some guesswork, and so on - as well as the experience of actual use, especially compliance failures (Bamford, 2002).

Let us take a step back here. Organisms are naturally produced by being reproduced, and not in order to satisfy any requirement or need. On the biological analogy, then, the reproduction of artifacts is treated as a basic or independent force in material culture, and hence as a given in analysis. Thus, according to Preston (2003), "it is the reproduction process that accomplishes and maintains the standardization of artifact form", which "in turn underwrites the standardization of function that is central to the whole notion of proper function" (p. 610). But the converse is true. A characteristic of buildings in Australia, assuming compliance with the BCA, will be certain minimum unobstructed widths of their exits, certain maximum distances to an exit, certain maximum distances between exits, and so on. Such characteristics are standard

not because they are reproduced; they are reproduced because they are standard or 'deemed-to-satisfy' the corresponding performance requirements. Standardization of form does not underwrite function; rather, it is function that underwrites or grounds standardization of form here.

In relation to *novel* artifacts, Preston (2003) claims that "the intentions of individual designers simply do not embody the knowledge or the control over ensuing social processes of reproduction for use", which would enable functions to be assigned to novel artifacts (p. 610). But again, we can see this is mistaken. As indicated above, on the BCA's verification mode, a novel feature of a building proposal can be verified as compliant with the Code by the provision of evidence in the form of engineering calculations, laboratory tests, demonstration prototypes, and so on. In this mode, a function is ascribed to a *novel* feature of an *as yet unbuilt* building (Bamford, 2014, p. 26). This is clearly a long way from the idea that conferring a function on a feature awaits a pattern of actual use. The role of actual use in determining function is to inform or test intentions, which is an extension of the role of observation and evidence in science - to help generate and test hypotheses (Bamford, 2002).

Preston is by no means alone in endorsing the actual use view of function. Others, however, often appeal to the decisions of actual users, and I conclude with a brief analysis of two such function theorists. Daniel Dennett (1990) says that "the inventor is not the final arbiter of what an artifact is, or is for; the *users* decide that" (p. 186). Bence Nanay (2013) adds a modal twist when he says: "The function of an artifact is fixed by what *would* contribute to the fulfilment of the goals of the agent who is using the artifact. … What it was designed for is irrelevant" (pp. 521−522).

Can the views of Dennett or Nanay above be reconciled with the operation of a building code? On Dennett's view, *any* way out of a burning spectator stand will count as an exit if a fleeing spectator decides to take it. If the spectator jumps over the railings or scrambles up onto the roof, these desperate escape routes would count as exits. In such a world, a building code would have no purchase because the *user* decides what is an exit, on the spot.

Nanay's (2013) modal or possible worlds account of function faces similar difficulties. He says:

> Artifact x has [the] function to do F at time t if and only if some 'relatively close' possible (but not actual) world where x is doing F at t and this contributes to the fulfillment of the goals of the agent who is using the artifact are closer to the actual world than any of those possible worlds where x is doing F at t, but this does not contribute to the fulfillment of the goals of the agent who is using the artifact. (pp. 521−522).

In 19th century New York, a 'relatively close' possible world in which a would-be escapee from a burning tenement uses the fire escape to successfully evacuate the building would be very likely *further* from the actual world than those possible worlds in which the tenant is trapped. Tenements were fire-traps, with or without fire escapes. On Nanay's account, the external 19th century fire escape (and the common door between apartments) seem to be not so much dysfunctional as lacking a function at all.

## 3 *Artifact function as intended use/intended effect*

To better understand the functions of artifacts, we need to recognize the role of the brief in design (and more generally, in procurement and selection) of artifacts. A designer's intentions are, or in general ought to be, grounded in the design brief. What is a brief? The Australian Institute of Architects (2018) provides the following short description of a building design brief that is sufficiently illustrative for our purposes:

> A design brief is a written statement which details the client's expectations and the functions of a proposed building. It should describe the facilities to be provided and the activities to be performed. It should also clearly identify the broad policies within which these are to be achieved in respect of the time, cost and quality. The brief should not propose specific design solutions. ('Brief', para. 1).

In general terms, the design brief for an artifact, **A**, consists of the *set of requirements*, R, for **A**, which are to be satisfied under the *set of conditions*, C, that is expected to obtain as or when **A** comes into existence or use (Mackie, 1977, pp. 53–59; Bamford, 1991, 2002; Parsons, 2016, p. 10). The requirements concerned with what **A** is supposed to do are its *functional* requirements, $R_F$, and hence the derived proper function of **A** is to satisfy $R_F$ under C.[12] Of course, a brief may be incomplete or vague, or largely implied, but rationally every design presupposes a brief. Thus, when, for example, a consumer regulatory authority says that items on the market should "do all the things someone would normally expect them to do", the authority is referring to the existence of an implied brief for every such item (Australian Competition and Consumer Commission, n.d., p. 1).

The failure to recognize the role of the brief in design fuels the *apparent* dilemma supposedly confronting intentionalist accounts of function, which Preston (2003) formulates as follows: if "the purpose of the designer establishes the proper function of the artifact designed, then the purpose of the user must equally establish the proper function of the artifact used" (p. 608) … so why privilege design? The question, however, is not one of privilege but obligation. A fire escape is designed to enable the occupants of a building to escape a fire in the building because that is what the occupants will want the

escape to do, in the event of a fire. In general, the purposes of the designer of an artifact are to satisfy the purposes of the user of the artifact, as expressed in the brief.[13] Designers and users thus have a substantive interest in agreeing or in reaching agreement about the proper functions of artifacts.

Evolutionary or causal historical theories of function in artifacts need to be significantly overhauled, to recognize the role of the brief. Similarly, some important *intentionalist* accounts of function and design require modification, which I shall illustrate by reference to the work of Pieter Vermaas and Wybo Houkes (2003, 2004, 2007, 2010). Vermaas and Houkes reconstruct the design of an artifact as the design of a "use plan" for that artifact, and then, "subordinately" or "secondarily", as the design of the artifact itself (Vermaas & Houkes, 2007, p. 41; Houkes & Vermaas, 2010, p. 26).

A use plan for something, X, is "a goal-directed series of considered actions" to achieve X's goals (Houkes & Vermaas, 2004, p. 57; see also Vermaas & Houkes, 2007, p. 34). The goal of a toaster is toast or the production of toast - and a use plan for the toaster to achieve this goal we expect to find in the accompanying manual (Vermaas & Houkes, 2007, p. 35; Houkes & Vermaas, 2010, pp. 18–20). To suppose that an artifact is designed to satisfy a use plan, however, overlooks the fact that a use plan is itself part of the design response to the brief (Vermaas & Houkes, 2007, p. 41). Moreover, it is not clear how we could arrive at a plan for how something is to be used when the thing itself has yet to be designed. In the Sydney Opera House, the foyer spaces are a destination with a view out over Sydney harbour, not merely a point of arrival for entry into a theatre (Utzon, 1956). This is a design idea about how the building will be used and experienced; it is not an architect's response to a pre-determined use plan. Physical design is not 'subordinate' to use planning, but integral and formative.

There are several reasons for thinking that use plans are too narrow for understanding function or design, and teasing this point out provides a fuller view of intended use. Here are four reasons. Firstly, artifacts have intended *effects* as well as intended *uses*. A user makes something happen with **A** when she enacts the use plan for **A**. But she can also have something happen to her by interacting with **A**, rather than by following any plan - and this can be something the designer intends. Such intended effects, like intended uses, are functional. The audience for the performance of a play, for example, has a theatrical experience that is due in part to the lighting of that performance. The lighting effects are the product of a goal-directed series of considered actions on the part of the stage manager, who is following a use plan. But the 'end-users' of the play, the audience, are not obviously following a use plan (or an effects plan) when they experience that performance, including its lighting effects. There is no use plan for *The Merchant of Venice*, for example, beyond the relevant theatrical and

behavioural conventions an audience would be expected to understand or observe.

Second, although an artifact does not have intended uses by *un*intended users, it can have intended *effects* on both unintended users and non-users. A prison may be intended to appear a harsh and forbidding place to both users and non-users alike, in order to discourage *anyone* in the jurisdiction from engaging in criminal activity. The conspicuous use or consumption of luxury goods can be intended to impress people who could not afford such goods or who are not entitled to consume them.

Third, the *prospective* or *expected* uses or effects of artifacts are not limited to their *intended* uses or effects, but typically include generally *unwanted* uses. Train passengers, for example, sometimes put their feet on the seats or jump up and down on them. Such misuse or abuse is not part of any use plan for the seats, of course, but it still calls for a design response. The designer may detail harder-wearing seats, for example, or configure the seats in such a way as to make them less attractive as trampolines. We might call this the 'coping with misuse' plan for the seats.

A use plan for an artifact may also need to control or eliminate unwanted side effects on recognized *non*-users of the artifact. A football stadium, for example, may satisfy the goals of its users (players, spectators, stadium owners, ground staff, media personnel, broadcast audiences etc.) but in so doing create unwanted or unacceptable levels of noise or light pollution for the stadium's neighbours, including perhaps roosting flocks of birds. A use plan for the stadium, therefore, would need to eliminate or control these unwanted side effects on its recognized non-users or third parties, both human and avian.

Fourth and last, there are many cases in which the intended users of an artifact may simply be unable to enact an ordered sequence of considered actions, such as a use plan envisages (Vermaas & Houkes, 2007, pp. 34–35). The intended users of a toy or an article of clothing, for example, may be non-human animals, babies or toddlers, or people variously with disabilities. The intended users of a fire escape may be in a state of panic. In such cases, a meta-use plan is needed, that is, a plan for how the goals of intended users can be achieved *without* those users having to follow a use plan.

Drawing on the above, a basic framework for an account of use in the design brief may be as follows. The prospective or expected uses or effects of the artifact, **A**, can be divided into its *intended* uses or effects and its *unintended* uses or effects. Some of the latter may also be *unwanted*, either by the intended users or by third parties. To satisfy $R_F$ under C, therefore, **A** needs to be designed to facilitate or to help bring about the *intended* uses or effects and to eliminate

or control the *unintended* uses or effects that are expected or thought likely to occur that are also *unwanted*.

## 4 Conclusion: a novel imagined future, function and the brief

When the architectural practice of Aldington and Craig (1980) was assembling the brief for a small family home, Anderton House, on the edge of a village in Devon, England, a conflict emerged between the clients (pp. 27–29). The husband wanted to continue working in the living room of their new home but his wife disliked the mess he invariably made. She wanted to enjoy the view of the distant countryside from their new living room unsullied by his mess. The wife insisted her husband have a separate study; he reluctantly agreed, but confessed he probably wouldn't use it.

The architects' design did *not* include a separate study. Instead, they proposed an open plan, split-level family space, with a kitchen and dining area on the upper level and, four steps down, a living area, that would command a view of the countryside. A small work-station, like an open-topped box, was inserted on the upper level, on the edge of the living area below. From lower down the box would read like part of the fabric of the space, with its inner goings-on largely obscured. The husband could look out over its low-height walls to the view and stay in touch with his wife, with little or no mess on show. Both husband and wife were extremely doubtful the architects' proposal would work and their doubts only increased once construction began. Only three weeks after moving into their new house, however, the clients declared the 'dog-house', as they nick-named the husband's work-station, the best thing about the place (The Landmark Trust, n.d.). The husband was house-trained at last and the spectre of a messy living room a thing of the past.

Anderton House illustrates the role of the brief in helping to bring into existence an imagined future with a novel function (one which, as it happens, worked as intended). If a biological function can be said to anticipate the future it is only in the sense of a future that is relevantly like the past or present, and this is clearly unlike the case of the 'dog-house'. Neither husband nor wife could even envisage the dog-house working, yet it was built. This seems to me the nub of the problem with the frequent, easy use of the biological analogy and the purportedly unified accounts of function in organisms and artifacts that have been erected upon it. Only a better understanding of design and the design process will be of assistance in overcoming this problem.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Notes

1. Newton's laws of motion depended on Newton for their formulation, but they are true or false independently of this fact. When John Searle (1995, p. 63) says that something is money only if we believe it is money, he is saying this belief is constitutive of the thing we call money.
2. Houkes and Vermaas (2004) claim that "function talk" is "part of a philosophical reconstruction of ordinary practice, linguistic and non-linguistic" (p. 55), but it is difficult to square this view with Neander's (1991) remarks above or the etymology of 'function' (OED, 2017).
3. A trial facility has been operating in Melbourne since 2018 (Department of Health and Human Services, 2020).
4. A new light-switch that is faulty is not there 'because of what it does' (it doesn't work); it is there because of what things of its *type* do. Thus, Wright equivocates here between 'X' and 'things of X's type'.
5. Room to stretch out is an affordance of five-across seating, not a function. But for our purpose, this does not matter because nor is an affordance 'automatic'.
6. Wright saw his formulation as "tenseless" (Neander, 2016, p. 51), which obscures the role of forethought. 'Allows' is in the present simple tense, which tense is used to indicate "actions or situations which happen repeatedly, all the time, or at any time" (Wallwork, 2013, p. 49), contributing to the impression of an absence of forethought.
7. The novel exists as multiple instances of the one work.
8. The proper functions of the designer's intentions derive, in turn, from the designer's cognitive mechanisms, which organs are members of higher-order reproductively established families (Millikan 1984).
9. The use of the past tense above in 'would have been' helps to obscure the gap between effects in the laboratory and later effects in the world at large.
10. Plato (1974, p. 246, *Republic*, 601d) distinguishes users, makers and imitators (such as painters or poets).
11. The full references are: D1.6 (c) (i), p. 132 and D1.6 (d) (ii), p. 132, respectively.
12. Requirements concerned **A**'s procurement, such as satisfying a budget or being delivered on time, are *in addition to* its functional requirements. If **A** is over-budget or overdue it is not thereby dysfunctional.
13. To the extent that a brief expresses the aims or ambitions of the designer, we should count designers *also* as users of the artifact concerned.

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