

Artifactual Functions: A Dual, Realizable-Based View

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Abstract

In this paper we provide an ontological analysis of so-called “artifactual functions” by deploying a realizable-centered approach to artifacts which we have recently developed within the framework of the upper ontology Basic Formal Ontology (BFO). We argue that, insofar as material artifacts are concerned, the term “artifactual function” can refer to at least two kinds of realizable entities: novel intentional dispositions and usefactual realized entities – which inhere, respectively, in what we previously called “canonical artifacts” and “usefacts”. We show how this approach can help to clarify functions in BFO, whose current elucidation includes reference to the term “artifact”. In our framework, having an artifactual function implies being an artifact, but not *vice versa*; in other words, there are artifacts that lack an artifactual function.

Keywords

artifactual function, realizable entity, disposition, function, role, Basic Formal Ontology (BFO)

1. Introduction

Artifacts and functions constitute important general categories. Each of them has been extensively investigated, as is witnessed by the fact that, in foundational ontology research and in philosophy, there are many extant theories of artifacts [1,2] and functions [3,4,5]. Relatedly, the connection between artifacts and functions has been also studied, as it is traditionally thought that “[f]unction is a salient feature of artifacts” [2] (e.g. a screwdriver and its function to turn screws) and a formal theory of artifacts has been developed with a focus on functions [6]. For that matter, it has been argued, based on empirical studies, that functional features are relevant to membership in artifact categorization [7]. Both artifacts and functions are nonetheless notoriously difficult to analyze from an ontological point of view and so is their complex relationship.

This paper aims to provide an ontological analysis of so-called “artifactual functions”, as the term “artifactual function” has been used very differently in different contexts and it is

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desirable to disambiguate the meaning of this polysemous term. For this purpose, we will leverage a realizable-centered approach to artifacts that we have developed in the recent work [8] within the framework of the upper ontology Basic Formal Ontology (BFO) [9,10,11]. In what follows, when we speak of and analyze the term “artifactual function” in this paper, it does not necessarily refer to a function in the BFO sense of the term. Throughout this paper, we use the term “artifactual function”, as well as the term “artifact”, in a very general sense of the terms.

The paper is organized as follows. As a preparatory stage, Section 2 summarizes a realizable-based account of material artifacts which was presented in our preceding work [8]. In particular, we introduce two kinds of material entities that can be referenced by the term “material artifact”: material canonical artifacts and material usefacts. Section 3 proposes two respectively corresponding kinds of realizable entities that can be referenced by the term “artifactual function”: novel intentional dispositions (Section 3.1) and usefactual realized entities (Section 3.2). We show how this proposal can help to clarify functions in BFO, as its current elucidation [10] includes reference to the term “artifact” (Section 3.3). We also discuss the resulting consequence that, according to our ontological analysis of the terms “artifactual function” and “artifact”, having an artifactual function implies being an artifact, but not *vice versa*: in other words, there are other ways of being an artifact than having an artifactual function (Section 3.4). Section 4 concludes the paper with a brief summary.

Some preliminary remarks are in order. To avoid confusion, we will write terms for type-level entities (universals, classes) in italics and terms for token-level entities (particulars, instances) in bold. Figure 1 provides an *is-a* hierarchy of classes used in this paper, where a class *A* being a subclass of a class *B* (which is expressed by the indentation) implies that all instances of *A* are instances of *B*. Note that some classes in Figure 1 are extracted from BFO and our work [8]. Table 1 explains realizable entities in BFO, i.e. dispositions, functions and roles.

BFO:Material entity
 Material canonical artifact (Section 2.2)
 Material usefact (Section 2.3; originally introduced in [8])
BFO:Realizable entity
 BFO:Disposition
 BFO:Function
 BFO:Role
 Intentional realizable entity (Section 2.2; originally introduced in [8])
 Novel intentional realizable entity (Section 2.2; originally introduced in [8])
 Novel intentional disposition (Section 3.1)
 Design BFO:function (Section 3.3)
 Usefactual realizable entity (Section 3.2)
 Usefactual realized entity (Section 3.2)
BFO:Process

Figure 1: An *is-a* hierarchy of classes used in this paper

Table 1

Realizable entities in BFO

Category	Definition/elucidation and explanation
disposition	A realizable entity that exists because of certain features of the physical makeup of the independent continuant that is its bearer. It is an “internally grounded realizable entity”: if a disposition ceases to exist, then the physical makeup of the bearer is changed. Example: the fragility of a glass and the flammability of a match.
function	A disposition of a bearer with a specific kind of historical development. It is a disposition that its bearer possesses in virtue of its having a certain physical makeup because of how it came into being, either through evolution (when the bearer is a natural biological entity) or intentional design (when the bearer is an artifact). ² Example: the function of the heart to pump blood through the body and the function of a screwdriver to turn screws.
role	A realizable entity that (1) exists because the bearer is in some special physical, social, or institutional set of circumstances in which the bearer does not have to be (optionality), and (2) is not such that, if this realizable entity ceases to exist, then the physical make-up of the bearer is thereby changed (external grounding). Example: the role of being a student and the role of a stone to mark a boundary.

2. Our Realizable-Centered Approach to Artifacts: In a Nutshell

In this section, we will summarize our realizable-centered approach to artifacts by drawing upon the text from our work [8] in which we discuss three fundamental views concerning the identity of artifacts (to be explained in Section 2.1), canonical artifacts (respectively: in Sections 2.1 and 2.2) and usefacts (respectively: in Section 2.1 and 2.3). Note that the terms “canonical artifact” and “material usefact” were defined in the work [8]; whereas the term “material canonical artifact” is introduced in the present paper in Section 2.2.

Our realizable-centered approach to artifacts aims to accommodate a wide range of artifacts, including so-called “material artifacts” (e.g. screwdrivers and clay pots) and “abstract artifacts” (e.g. computer programs and the novel *Robinson Crusoe*). Because this paper focuses primarily on material artifacts, we will adumbrate below our realizable-based account of material artifacts.

2.1. Basic Idea

There are at least three different fundamental views for characterizing material artifacts, depending on different criteria for the diachronic identity of material entities. We illustrate

² “‘Came into being’ here strongly suggests that a functional disposition is one whose existence helps to causally explain the existence of the entity, or at least of the physical structure, that it is a disposition of” [10, p. 126]

these views with the example of a pot made of an amount of clay at time t_1 when it is intentionally shaped and dried:

- The *continuity view*: At time t_1 , this amount of clay (**clay**₁) continues to exist and becomes a pot (that is: **clay**₁ comes to instantiate the artifact kind *Pot*).
- The *discontinuity view*: At time t_1 , **clay**₁ ceases to exist and a new material entity **pot**₀ (which instantiates the artifact kind *Pot*) comes into being.
- The *constitution view*: At time t_1 , **clay**₁ continues to exist and a new material entity **pot**₀ (constituted by, but distinct from, **clay**₁) comes into being. (see e.g. [12])

In what follows, we will assume the continuity view, as the core of the realizable-centered approach to artifacts can be easily presented under this view — except that we assume the discontinuity or constitution view in discussing functions in BFO in Section 3.3, as the BFO notion of a function does not seem to embrace the continuity view. This, in turn, helps to illustrate how the kernel of our approach can be, *mutatis mutandis*, preserved under these other two views.

We think that, in light of a number of existing theories of artifacts (as illustrated by various formal-ontological theories of technical artifacts [1]), there are at least two different, albeit related, entities that can be referents of the term “artifact”: *canonical artifacts* and *usefacts* in our terminology. Since the focus of this paper is upon material artifacts, we will introduce the terms “material canonical artifact” and “material usefact”, which can be elucidated as follows:

- A material canonical artifact is a material entity that is intentionally produced for some purpose. Cf. [2]
- A material usefact is a material entity that is intended to be used for some purpose (other than the purpose for which it was intentionally produced, if it was), whether it is being actually used for that purpose or not. (Cf. [12,13] for the contrast between use intention — even without an associated actual use — and actual use.)

To illustrate these terms, we introduce the following examples:

- This amount of clay (**clay**₁) is intentionally shaped and dried to be able to contain liquid (i.e. to serve as a pot) at time t_1 and **clay**₁ becomes a material canonical artifact at time t_1 .
- At time t_1' (later than time t_1), **clay**₁ is intended by a user to be used to contain liquid, even without being actually used for that purpose; and **clay**₁ continues to be a material canonical artifact — but it does not become a material usefact at time t_1' because it is intended to be used for the same purpose as it was intentionally produced.
- At time t_1'' (later than time t_1'), **clay**₁ is intended to be used to hold a door (i.e. to serve as a door stop) even without being actually used for that purpose; and, while continuing to be a material canonical artifact, **clay**₁ also becomes a material usefact at time t_1'' .

- This pebble (**pebble₂**) is intended to be used to keep papers in place at time t_2 (i.e. to serve as a paperweight), even without being actually used for that purpose; and **pebble₂** becomes a material usefact at time t_2 . Cf. [12]

We also introduce realizable entities which are involved in these examples:

- **clay₁** comes to bear the disposition **d₁** to contain liquid, at time t_1 .
- **clay₁** comes to bear the role **r₁** to contain liquid, at time t_1' .
(Note that, unlike **d₁**, **r₁** can cease to exist even without its physical makeup being changed, in particular when **clay₁** is no longer intended to be used to contain liquid.)
- **clay₁** comes to bear the role **r₁*** to hold a door, at time t_1'' .
- **pebble₂** comes to bear the role **r₂** to keep papers in place, at time t_2 .

In what follows we will present definitions of material canonical artifacts (Section 2.2) and material usefacts (Section 2.3; originally defined in the work [8]) by analyzing these realizable entities figuring in the examples.

2.2. Material Canonical Artifact

Following the work [8], we define material canonical artifacts in terms of *intentional realizable entities* and *novel realizable entities*:

- intentional realizable entity =_{def.} A realizable entity that comes into being for a specific goal through intentional act.
(Note that the term “intentional act” therein is general enough to accommodate Borgo & Vieu’s [12] notion of “mental selection”.)
- novel realizable entity =_{def.} A realizable entity r such that the bearer has no realizable entity r' such that (i) r' exists before r comes into being and (ii) if r is realized in a process, then r' is realized in the same process.
(Note that the term “the same process” therein refer to the same particular process.)

The four realizable entities above introduced (viz. **d₁**, **r₁**, **r₁*** and **r₂**) are all intentional realizable entities. For instance, **d₁** comes into being through the intentional act of shaping and drying **clay₁**, and **d₁** is directed towards the goal of liquid being contained in **clay₁**; and **r₂** comes into being through the intentional act of selecting **pebble₂** to use it as a paperweight and **r₂** is directed towards the goal of keeping papers in place because of **pebble₂**.

Moreover, **d₁** is a novel realizable entity because **clay₁** at time t_1 would bear no realizable entity such that it exists before **d₁** comes into being and that, if **d₁** is realized in a process, then it is realized in the same process. As **clay₁** at time t_1 (bearing **d₁**) is a material canonical artifact in the elucidated sense of the term in Section 2.1, we can define the term “material canonical artifact” as follows:

material canonical artifact =_{def.} A material entity that bears a novel intentional realizable entity.

The idea is that a material entity being a canonical artifact amounts to the material entity bearing an intentional realizable entity whose realization of a “new” kind for the material entity which is the bearer — hence, a novel intentional realizable entity (i.e. a realizable entity that is novel and intentional). Note that neither r_1^* nor r_2 is a novel realizable entity, as we will explain in detail below.

2.3. Material Usefact

In the work [8], we defined the term “material usefact” as a material entity that bears not a novel intentional realizable entity, but a realizable entity of a different (albeit closely related) kind. To present our definition of this term, let us introduce two realizable entities with regard to **clay**₁ and **pebble**₂:

- **clay**₁ bears the disposition d_1^* to hold a door after time t_1 — note that, unlike r_1^* , d_1^* exists even in the absence of any relevant use intention (e.g. between times t_1 and t_1'), insofar as the physical makeup (e.g. solid structure) of **clay**₁ remains unchanged.
- **pebble**₂ bears the disposition d_2 to keep papers in place — note that, unlike r_2 , d_2 exists even in the absence of any relevant use intention (e.g. before time t_2), insofar as the physical makeup (e.g. solid structure) of **pebble**₂ remains unchanged.

We also introduce, following the work [8], the relation of “being non-novel in virtue of” between two realizable entities as follows:

A realizable entity r is non-novel in virtue of a realizable entity r'
=_{def.} There exists some independent continuant b such that (i) b bears r and (ii) b bears r' and (iii) r' exists before r comes into being and (iv) if r is realized in a process, then r' is realized in the same process.

Then we can classify the three roles r_1 , r_1^* and r_2 as follows:

- Non-novel in virtue of some novel intentional realizable entity
 - the role r_1 of **clay**₁ is non-novel in virtue of d_1 (and **clay**₁ at time t_1' is a material canonical artifact but not a material usefact.)
- Non-novel in virtue of some realizable entity that is not a novel intentional realizable entity
 - the role r_1^* of **clay**₁ is non-novel in virtue of d_1^* (and **clay**₁ at time t_1' is both a material usefact and a material canonical artifact.)
 - the role r_2 of **pebble**₂ is non-novel in virtue of d_2 (and **pebble**₂ at time t_2 is a material usefact but not a material canonical artifact.)

As **clay**₁ at time t_1 ” (bearing r_1^*) and **pebble**₂ at time t_2 (bearing r_2) are material usefacts in the elucidated sense of the term in Section 2.1, we can define the term “material usefact” as follows:

material usefact =_{def.} A material entity that bears an intentional realizable entity which is non-novel in virtue of some realizable entity that is not a novel intentional realizable entity.

3. A Realizable-Based Analysis of Artifactual Functions

3.1. Novel Intentional Dispositions of Material Canonical Artifacts

We proposed two kinds of material entities that can be referred to by the term “material artifact”: material canonical artifacts and material usefacts. We will provide an ontological analysis of so-called “artifactual functions”, as they can apply to these two categories of entities, i.e. material canonical artifacts and material usefacts. Let us first consider artifactual functions of material canonical artifacts. Using our illustrative examples, **clay**₁ at time t_1 is a material canonical artifact. Because **clay**₁ at time t_1 bears d_1 , we may think of d_1 as an artifactual function of a material canonical artifact. This way of thinking may lead to focusing on the term “novel intentional disposition”:

novel intentional disposition =_{def.} A novel intentional realizable entity that is a disposition.

We can interpret the term “artifactual function” as referring to a novel intentional disposition in situations where the term “artifact” refers to a material canonical artifact. For instance, d_1 is a novel intentional disposition.

We make two remarks on this interpretation of artifactual functions of material canonical artifacts as novel intentional dispositions. Firstly, there is a long-standing debate over the problem of malfunction(ing) for the BFO dispositional theory of functions [4,10,14]. This problem could also be raised for the present construal of the term “artifactual *function*” as referring to a novel intentional *disposition*. A complete resolution of this potential issue exceeds the scope of this paper, though (for some thoughts, see Koslicki’s [15] and Koslicki & Massin’s [16] discussion on malfunctioning).

Secondly, one may wonder whether (and why), in the case of material canonical artifacts, the term “artifactual function” refers to a novel intentional *disposition*, rather than a novel intentional *realizable entity*. One consideration in favor of the affirmative answer to this question may be provided in light of the central features of the BFO notion of a function. In developing their BFO dispositional account of functions, Spear et al. [10] discuss Röhl & Jansen’s [4] SUPPORT desideratum for a satisfactory theory of functions. Spear et al. formulate it as follows:

SUPPORT: the function of a thing should be, in some sense, supported by (be a consequence of) its physical structure, not merely of historical or cultural facts. [10, p. 107]

Spear et al. also argue that the BFO notion of a function “conforms to Röhl and Jansen’s criterion of SUPPORT, which requires that functions be grounded in the physical structure of their bearers” [10, p. 121], not least because BFO:functions are dispositions, which are borne in virtue of certain features of the physical make-up of the bearers. This argument may lend weight to thinking that artifactual functions of material canonical artifacts would be favorably analyzed in terms of novel intentional *dispositions*. We also note that this interpretation can be strengthened by our clarification of functions in BFO (Section 3.3) and our detailed discussion about the SUPPORT desideratum (Section 3.4).

3.2. Usefactual Realized Entities of Material Usefacts

We will now turn to artifactual functions of material usefacts. Using our illustrative examples, **clay**₁ at time t_1 ” (when it is intended to be used to hold a door, regardless of an associated actual use) and **pebble**₂ at time t_2 (when it is intended to be used to hold papers, regardless of an associated actual use) are material usefacts. Because **clay**₁ at time t_1 ” bears r_1^* and **pebble**₂ at time t_2 bears r_2 , one possible interpretation (which we will scrutinize below, though) is to think of r_1^* and r_2 as artifactual functions of material usefacts. To generalize this idea, we can introduce the term “usefactual realizable entity”:

usefactual realizable entity =_{def.} An intentional realizable entity (i) of an independent continuant (ii) which is non-novel in virtue of some realizable entity that is not a novel intentional realizable entity.

According to this interpretation, the term “artifactual function” refers to a usefactual realizable entity in situations where the term “artifact” refers to a material usefact (see also Toyoshima et al.’s [13] notion of a “broad use function”). For instance, r_1^* and r_2 are usefactual realizable entities borne by material usefacts, and thus might be called “artifactual functions”. (We leave open the question of whether all usefactual realizable entities are BFO:roles or not, because a well-developed account of BFO:roles is yet to be available; for thoughts, see Röhl & Jansen [4] and Toyoshima et al. [17].)

There may be nonetheless some issues with this simple identification of an artifactual function of a material usefact with a usefactual realizable entity thereof. For one thing, in replying to Artiga [5], Spear et al. [10] critically examine “the possibility of artifactual functions that come into existence solely as the result of intentionally selecting a natural object (what Artiga also calls a ‘naturefact’) or repurposing an already existing artifact” [10, p. 126] — where the term “natural object” can admit of an intuitive reading (consider e.g. **pebble**₂) and such “artifactual functions” in Spear et al.’s terms would correspond to those of material usefacts, as we argued in the work [8] that our notion of a usefact is related with, and more general than, the anthropological notion of a naturefact [18].

Spear et al. state: “when sticks from the woods are *merely intentionally selected* to be used as chopsticks, then they do not take on or have a function at all in the BFO sense, but rather a *role*” [10, p. 126]; and “naturefacts and of (merely intentionally) repurposed artifacts generally [...] do not have functions in the BFO sense; but rather roles which, precisely because they do not play any part in explaining the existence of the entities that

bear them, are entities of a different kind” [10, p. 127]. In Spear et al.’s spirit, we may want to draw a sharp distinction between bearing a BFO:function and bearing a usefactual realizable entity (which can be paradigmatically a BFO:role), instead of drawing some kind of analogy between them and calling, even if loosely, the latter “having a function”.

Furthermore, it would seem that Artiga [5] does *not* think that, for instance, the natural object **pebble**₂ has a function at time t_2 . To see this, consider his following text:

Think about naturefacts, that is, natural objects that have not been created by humans but which might acquire functions. If a stone with a convex whole is used as a mortar, it seems it has a function, even if this effect does not explain why it exists: neither its presence nor its form can be explained by appealing to its function.

[5, p. 93, our underline added]

Let us apply Artiga’s view of naturefacts and functions, more generally, to our examples of material usefacts. We introduce the following scenarios with their ontological analysis:

- At time t_1''' (later than time t_1''), **clay**₁ is actually used to hold a door.
- At time t_2' (later than time t_2), **pebble**₂ is actually used to keep papers in place.
- At time t_1''' : r_1^* (borne by **clay**₁) is realized.
- At time t_2' : r_2 (borne by **pebble**₂) is realized.

Following Artiga, we can think that, at time t_1''' (or at time t_2'), **clay**₁ (or **pebble**₂) “has a function” — to wit, it has an artifactual function of a material usefact.

There are at least two interpretations for artifactual functions of material usefacts. We may call them the “process-based” and “realizable-based” interpretations. To illustrate the former, we will consider Bahr’s [19] notion of a “sporadic user-intended function” when she provides a unifying account of both function ascriptions to technical artifacts and those to artworks. She characterizes sporadic user-intended functions as follows:

A subject s is justified in ascribing Φ -ing as a sporadic user-intended function to a technical artifact, an art work [which would be a class in our terms] or an instance of an art work a if and only if

s is justified in believing that a user of a currently intends to use a as a means of Φ -ing [the *condition of user-intention*]; and

s is justified in believing that a is actually serving as a means of Φ -ing [the *condition of actual fulfillment*]

[19, p. 98, with some notational modifications for readability]

Suppose for the sake of illustration that I am justified in believing that **clay**₁ is intended to be used (the condition of user-intention) and actually used (the condition of actual fulfillment) at time t_1''' , as a mean of holding a door. Then, I am justified in ascribing holding a door (i.e. serving as a door stop) as a sporadic user-intended function to **clay**₁ at time t_1''' . This analysis is arguably, *mutatis mutandis*, applicable to **pebble**₂ at time t_2' . Note that, at

least when the expression “ Φ -ing” is literally taken, sporadic user-intended functions would be processes (e.g. realizations of r_1^* and realizations of r_2).

The other, realizable-based interpretation of artifactual functions of material usefacts can be found in Toyoshima et al.’s [13] notion of a “narrow use function”, which is based on the idea that: “it is not enough to merely intend to use something for a use function to come into being: a thing has a use function (in the narrow sense) only when the user *actually* uses that thing for her use purpose” [13, p. 5]. According to their considered view, for instance, **clay**₁ at time t_1 ” (or **pebble**₂ at time t_2)’ has a narrow use function to hold a door (or to keep papers in place) and this narrow use function can be analyzed as “ r_1^* when it is realized” (or “ r_2 when it is realized”).

Interpreted generally within our framework, the process-based interpretation says that artifactual functions of material usefacts are realizations of usefactual realizable entities. The realizable-based interpretation says, by contrast, that they are usefactual realizable entities when they are realized, or more simply “usefactual realized entities” in the following sense of the term:

usefactual realized entity =_{def.} A usefactual realizable entity that is realized.

While both interpretations of artifactual functions of material usefacts may be plausible, we will adopt here the realizable-based interpretation of them as usefactual realized entities, as it will yield the desirable consequence that so-called “artifactual functions” can be uniformly characterized as realizable entities, whether they are novel intentional dispositions (in the case of material canonical artifacts) or usefactual realized entities (in the case of material usefacts). There is nonetheless an important ontological difference between these two kinds of realizable entities: that is, a usefactual *realized* entity is always being realized; but a novel intentional disposition (and also a usefactual realizable entity) can go unrealized — cf. [4,10] for the view that the notion of a realizable entity helps to distinguish between “functions” (continuants) and “functionings” (occurrents).³

3.3. Clarifying Functions in BFO

We will clarify functions in BFO, insofar as they are concerned with artifacts, in particular with our realizable-centered approach to them. For the sake of referential convenience, let us introduce the term “design BFO:function”, adapted from the BFO elucidation of functions:

³ It is interesting to note that the difference between a novel intentional disposition and a usefactual realized entity may be linked with the distinction between “having a function” and “functioning as” that is suggested by Artiga’s [5] following text:

It seems that, among functions, we also frequently distinguish those that are essential (or, at least, more central) from those that are not. Chairs are for sitting, but one can also stand on them to reach for something. Cups are for drinking, but they can also function as pencil cups. Among the various functions an item may have, some of them seem to be more important than others. One way of capturing this idea is in terms of the distinction between *having a function* and *functioning as*. [...] even though this distinction is also likely to make sense in a biological context, artifacts provide much clearer examples. [5, p. 93]

design BFO:function =_{def.} A BFO:function that its bearer possesses in virtue of its having a certain physical makeup because it came into being through intentional design (when the bearer is an artifact).

The first thing to note is that the notion of a design BFO:function does not seem to assume the continuity view. To see this, recall our analysis of the example of a pot made of an amount of clay at time t_1 when it is intentionally shaped and dried, in terms of \mathbf{clay}_1 and \mathbf{d}_1 under the continuity view:

- At time t_1 , this amount of clay (\mathbf{clay}_1) continues to exist and becomes a pot (that is: \mathbf{clay}_1 comes to instantiate the artifact kind *Pot*).
- \mathbf{clay}_1 comes to bear the disposition \mathbf{d}_1 to contain liquid, at time t_1 .

Note that \mathbf{d}_1 is a novel intentional disposition (and \mathbf{clay}_1 is thus a material canonical artifact), but it is not a BFO:function (and, *a fortiori*, \mathbf{d}_1 is not a design BFO:function, either), since \mathbf{clay}_1 does not come into being at time t_1 . By assuming the discontinuity or constitution view, however, we can analyze the clay/pot example in terms of BFO:functions as follows:

- At time t_1 , a new material entity \mathbf{pot}_0 comes into being.
- \mathbf{pot}_0 bears the design BFO:function \mathbf{f}_0 to contain liquid.

Note that \mathbf{f}_0 is a novel intentional disposition (and \mathbf{pot}_0 is thus a material canonical artifact). In particular, \mathbf{f}_0 is “trivially novel” in the sense that neither its bearer (i.e. \mathbf{pot}_0) nor any realizable entity of the bearer existed before \mathbf{f}_0 comes into being, since all these entities come into being simultaneously (cf. our work [8] for the notion of “trivial novelty”).

This observation can have two important implications for functions in BFO. Firstly, the term “artifact” in the BFO elucidation of functions can be construed as referring to a material canonical artifact because any design BFO:function (e.g. \mathbf{f}_0 borne by \mathbf{pot}_0) is a novel — to wit, “trivially novel” — intentional disposition. Secondly, irrespective of such fundamental views of the identity of artifacts as continuity/discontinuity/constitution, our notion of a novel intentional disposition would be more general than the notion of a design BFO:function, although we leave for future work discontinuity- or constitution-based reformulations of our realizable-centered treatment of artifacts and artifactual functions.

3.4. Being an Artifact Otherwise Than in Virtue of Having an Artifactual Function

In Section 3.1, we justified the thesis that artifactual functions of material canonical artifacts are novel intentional dispositions, on the grounds of the SUPPORT desideratum for a satisfactory theory of functions. We will solidify this justification by examining closely Artiga’s [5] criticism of the SUPPORT desideratum. Artiga discusses the SUPPORT desideratum in connection with artifactual functions as follows:

I doubt that SUPPORT should actually count as a desideratum for a theory of artifactual functions. The main difficulty concerns the notion of “support”, which is

not only too unspecific, but also probably unspecifiable. For instance, the function of an amulet is to bring luck, but it is unclear what would be for an object to support this function. Likewise, in many cultures animal sacrifices have the function of pleasing gods, but we do not know what would be required for an object to support this effect. In general, it is mysterious what kinds of physical properties could support many of these functions and, even if we knew it, these items would probably lack them. Less extreme cases can also be pointed out. If one thinks about the function of the Bible, or the Communist Manifesto, the connection between the structural properties of the object (either an abstract entity or an object made out of ink and paper) and their function seems to be hard to spell out. That suggests there is probably no general way of specifying the relation between support and function, in a such way that it can deliver a substantive and plausible requirement. [5, p. 94]

We will make two points on this excerpt. Firstly, Artiga thinks of the function of amulets to bring luck and the function of sacrificed animals to please gods. From our realizable-based perspective on artifacts, it may be difficult to think that amulets (or sacrificed animals) are material canonical artifacts, or even material usefacts, in virtue of bearing realizable entities to bring luck (or to please gods), because it is implausible to identify such realizable entities, in particular given modern science.

To analyze amulets and sacrificed animals, it will be helpful to consider Koslicki & Massin's [20] notion of a "faith-based artifact": roughly, an artifact of a kind that is intended and believed by its creators and users to perform a function which it does not in fact perform (see also Koslicki & Massin's [16] discussion about different theories of functions with regard to artifacts). As K&M say, examples of faith-based artifacts can range from religious and ritualistic objects (e.g. amulets and talismans) to amber necklaces. They also suggest that faith-based artifacts can be analyzed in terms of their notion of a "placebo capacity": roughly, a capacity to subjectively satisfy an agent's desire to produce the relevant effect in the presence of a belief by the agent that the entity is able to bring about this effect. For instance, amulets can be ascribed the placebo capacities to subjectively satisfy the user's desire to get lucky in the presence of the relevant belief on the part of the agent that they can in fact bring luck, although they actually lack the capacity to bring luck.

Artiga argues that the function of amulets to bring luck and the function of sacrificed animals to please gods can constitute counterexamples to the SUPPORT desideratum. One possible realizable-based interpretation of his argument is that amulets and sacrificed animals could be material canonical artifacts in virtue of bearing novel intentional realizable entities that are not dispositions (recall our discussion on SUPPORT and dispositions in Section 3.1). We hypothesize that K&M's placebo capacities are one promising candidate for such non-disposition realizable entities, as amulets and sacrificed animals would be faith-based artifacts. It will be therefore valuable to formalize faith-based artifacts and placebo capacities within our realizable-centered framework for artifacts.

Secondly, Artiga thinks that, although being unspecified by him, functions of the Bible and the Communist Manifesto can also constitute counterexamples to the SUPPORT desideratum because the connection between these functions and the "structural properties" of the function bearers "seems to be hard to spell out". In the work [8], we

elaborated the notion of an “abstract canonical artifact” to account for so-called “abstract artifacts” (see Section 2.1) in compliance with BFO. This notion will be useful in analyzing the artifact-ness of the Bible and the Communist Manifesto.

Moreover, the examples of the Bible and the Communist Manifesto can be linked with K&M’s faith-based artifacts because, as they say, abstract artifacts such as specific theories and ideologies (e.g. conspiracy theories) could also be regarded as faith-based artifacts. Therefore, a full ontological analysis of such abstract artifacts may require the integration of abstract canonical artifacts and a realizable-based account of faith-based artifacts.

An important lesson to be learnt from this careful reading of Artiga’s text is that, notwithstanding a traditionally assumed, inextricable relationship between artifacts and functions, our ontological analysis of the terms “artifactual function” and “artifact” says that having an artifactual function implies being an artifact, but not *vice versa*: to put it differently, there are other ways of being an artifact than having an artifactual function (see also Koslicki & Massin’s [16] criticism of what they call “functionalism about artifact kinds”).

Finally, we remark that it is an open question whether the term “artifactual function” should universally (e.g. in any domain) refer either to novel intentional dispositions only, or to both novel intentional dispositions and usefactual realized entities — as well as (as we argued in the work [8]) whether the term “artifact” should universally refer either to canonical artifacts only, or to both canonical artifacts and usefacts.

4. Conclusion

To recapitulate briefly, we provided an ontological analysis of so-called “artifactual functions” by deploying a realizable-centered approach to artifacts that we have developed, in the recent work [8], based on Basic Formal Ontology (BFO). The result is that artifactual functions of material canonical artifacts and material usefacts can be analyzed in BFO, respectively, as novel intentional dispositions (e.g. d_1 borne by $clay_1$ at time t_1 under the continuity view, as well as the design BFO:function f_0 borne by pot_0 under the discontinuity/constitution view) and usefactual realized entities (e.g. the realized role r_1^* to hold a door that is borne by $clay_1$ at time t_1 ” and the realized role r_2 to keep papers in place that is borne by $pebble_2$ at time t_2 ’). One important consequence that, according to our ontological analysis of the terms “artifactual function” and “artifact”, having an artifactual function implies being an artifact, but not *vice versa*. Through these discussions (as in Sections 3.3 and 3.4), we also suggested some possible future directions of inquiry, including a realizable-based formalization of faith-based artifacts and placebo capacities.

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References

- [1] S. Borgo, M. Franssen, P. Garbacz, Y. Kitamura, R. Mizoguchi, P. E. Vermaas. Technical artifacts: an integrated perspective, *Applied Ontology*, 9(3-4) (2014) 217-235.

- [2] B. Preston, Artifact, in: E. N. Zalta, U. Nodelman (Eds.), *The Stanford Encyclopedia of Philosophy*, Winter 2022 Edition.
URL: <https://plato.stanford.edu/archives/win2022/entries/artifact/>.
- [3] A. Wouters, The function debate in philosophy, *Acta Biotheoretica*, 53(2) (2005) 123-151.
- [4] J. Röhl, L. Jansen. Why functions are not special dispositions: an improved classification of realizables for top-level ontologies, *Journal of Biomedical Semantics*, 5:27 (2014).
- [5] M. Artiga, New perspectives on artifactual and biological functions, *Applied Ontology*, 11(2) (2016) 89-102.
- [6] N. Troquard, A formal theory for conceptualizing artefacts and tool manipulations, in: *Proceedings of FOIS2014*, Amsterdam: IOS Press, 2014, pp. 119-132.
- [7] M. E. Barton, L. K. Komatsu, Defining features of natural kinds and artifacts, *Journal of Psycholinguistic Research*, 18 (1989), 433-447.
- [8] F. Toyoshima, A. Barton, K. Koslicki, O. Massin. Artifacts, production and realizables. Under review. Temporarily available at: https://drive.google.com/file/d/1s4iVC5MKJ1EZYIOdxLwVUIO5e_X38qpb/view?usp=sharing
- [9] R. Arp, B. Smith, A. D. Spear, *Building Ontologies with Basic Formal Ontology*, MIT Press, 2015.
- [10] A. D. Spear, W. Ceusters, B. Smith, Functions in Basic Formal Ontology. *Applied Ontology*, 11(2) (2016) 103-128.
- [11] J. N. Otte, J. Beverley, A. Ruttenberg, BFO: Basic Formal Ontology, *Applied Ontology*, 7(1) (2022) 17-43.
- [12] S. Borgo, L. Vieu, Artefacts in formal ontology, in: A. Meijers, (Ed.), *Philosophy of Technology and Engineering Sciences: Handbook of the Philosophy of Science*, vol. 9, Elsevier, 2009, pp. 273-307.
- [13] F. Toyoshima, A. Barton, J. F. Ethier, Investigating functions in BFO from the viewpoint of extrinsic dispositions, in: *Proceedings of JOWO2022, CEUR Workshop Proceedings*, vol. 3249, 2022, pp. 1-7.
- [14] L. Jansen, Functions, malfunctioning, and negative causation, in: A. Christian et al. (Eds.), *Philosophy of Science: Between the Natural Sciences, the Social Sciences, and the Humanities*, vol. 9, Cham: Springer Verlag, 2018, pp. 117-135.
- [15] K. Koslicki, Artifacts and the limits of agentive authority, in: M. Garcia-Godinez (Ed.), *Thomasson on ontology*, Springer Verlag, 2023, pp. 209-241.
- [16] K. Koslicki, O. Massin, Artifact kinds, functions, and capacities. Under review.
- [17] F. Toyoshima, A. Barton, J. F. Ethier, L. Jansen, Towards a unified dispositional framework for realizable entities, in: *Proceedings of FOIS2021*, Amsterdam: IOS Press, 2024, pp. 64-78.
- [18] W. H. Oswalt, *An Anthropological Analysis of Food-Getting Technology*, New York: John Wiley & Sons, 1976, p. 18ff.
- [19] A. Bahr, What the Mona Lisa and a screwdriver have in common: a unifying account of artifact functionality, *Grazer Philosophische Studien*, 96 (2019) 81-104.
- [20] K. Koslicki, O. Massin, Artifact-essences: a capacity-based approach. Under review.