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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. They 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].[2] 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 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

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[2] For that matter, it has been argued, based on empirical studies, that functional features are relevant to membership in artifact categorization [7].

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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.

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 companion work [8]. In particular, we introduce two kinds of material entities in our terms: *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.

Figure 1 provides a taxonomy of classes used in this paper, including terms denoting classes that are already established within BFO and in our companion work [8] as well as new terms to be introduced in this paper.[3] In order for a class *A* to be a subclass of a class *B* (which is expressed by the indentation), all instances of *A* must be instances of *B*. Table 1 explains realizable entities in BFO, i.e. dispositions, functions and roles.

BFO:*Material entity*
- *Material canonical artifact* (Section 2.2; originally introduced in [8])
- *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

[3] For the sake of terminological clarity, we will occasionally write names for particular or token-level entities in bold (e.g. "**clay**$_1$") and for kinds or type-level entities in italics (e.g. "*Pot*"), respectively. We will also occasionally use a subscript for entity names in BFO (e.g. "BFO:function").

Table 1
Realizable entities in BFO[4]

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).[5] 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 our companion work [8]. In particular, we will explain three philosophical views concerning the identity of diachronic identity and the informal notions of canonical artifact and usefact (Section 2.1), the definition of the term "canonical artifact" (Section 2.2), and the definition of the term "material usefact" (Section 2.3).

2.1. Basic idea

We illustrate some philosophical views of diachronic identity with the example of a pot made of an amount of clay which is intentionally shaped and dried at time t_1:

- The *continuity view*: At time t_1, this amount of clay (**clay$_1$**) continues to exist and **clay$_1$** comes to instantiate the artifact kind *Pot*.
- The *non-continuity* view: At time t_1, a new material entity **pot$_2$** (which instantiates the kind *Pot*) comes into being.

[4] For general thoughts on realizable entities in BFO, see Röhl & Jansen's [4] and Toyoshima et al.'s [12] analysis of being internally/externally grounded and (non-)optionality.
[5] " '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]

a. The *discontinuity view*: At time t_1, $\mathbf{clay_1}$ ceases to exist and a new material entity $\mathbf{pot_0}$ comes into being.
b. The *constitution view*: At time t_1, $\mathbf{clay_1}$ continues to exist and a new material entity $\mathbf{pot_0}$ (constituted by, but distinct from, $\mathbf{clay_1}$) comes into being. (see e.g. [13])

We will assume the continuity view to provide a systematic analysis of the relationship between production and use under the same philosophical view of diachronic identity. Note that the so-called "production" of a material artifact may be usually associated with the non-continuity view; but, under the continuity view, it does not imply the coming into being of a new *material* entity, but rather the coming into being of a new *realizable* entity as detailed below. Note also that we will assume the non-continuity view in discussing functions in BFO in Section 3.3, as the BFO notion of function seems to embrace the non-continuity view.

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 help to better understand the usage of the term "artifact": *canonical artifacts* and *usefacts* in our terminology. We introduce the terms "material canonical artifact" and "material usefact", which can be informally explained as follows:

- A material canonical artifact is a material entity that is intentionally produced for some purpose.
- A material usefact is a material entity that is intended to be used for some purpose (other than the original purpose for which it was intentionally produced, if any).[6]

To illustrate these terms, we introduce the following examples:

- This amount of clay ($\mathbf{clay_1}$) is intentionally shaped and dried to be able to contain liquid at time t_1 and $\mathbf{clay_1}$ becomes a material canonical artifact at time t_1.
- At time t_1' (later than time t_1), $\mathbf{clay_1}$ is intended to be used to contain liquid and $\mathbf{clay_1}$ 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'), $\mathbf{clay_1}$ is intended to be used to hold a door and, while continuing to be a material canonical artifact, $\mathbf{clay_1}$ also becomes a material usefact at time t_1''.
- This pebble ($\mathbf{pebble_2}$) is intended to be used to keep papers in place at time t_2 and $\mathbf{pebble_2}$ becomes a material usefact at time t_2. Cf. [13]

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

- $\mathbf{clay_1}$ comes to bear the disposition $\mathbf{d_1}$ to contain liquid, at time t_1.

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[6] Throughout this paper we employ the expression "be intended to be used to do" to mean being intended to be used to do, independently of whether it is actually used for that purpose or not. See the works [13,14] for the contrast between use intention (even without an associated actual use) and actual use.

- **clay**$_1$ comes to bear the role **r**$_1$ to contain liquid, at time t_1'.[7]
- **clay**$_1$ comes to bear the role **r**$_1$* to hold a door, at time t_1''.
- **pebble**$_2$ comes to bear the role **r**$_2$ 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) by analyzing these realizable entities figuring in the examples. Note that these definitions were originally presented in our companion paper [8].

2.2. Material canonical artifact

Following our companion 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 an intentional act.[8]
- 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.[9]

The four realizable entities above introduced (viz. **d**$_1$, **r**$_1$, **r**$_1$* and **r**$_2$) are all intentional realizable entities. For instance, **d**$_1$ comes into being through the intentional act of shaping and drying **clay**$_1$, and **d**$_1$ is directed towards the goal of liquid being capable of containing in **clay**$_1$; and **r**$_2$ comes into being through the intentional act of selecting **pebble**$_2$ to use it to keep papers in place and **r**$_2$ is directed towards the goal of keeping papers in place because of **pebble**$_2$.[10]

Moreover, **d**$_1$ is a novel realizable entity because **clay**$_1$ at time t_1 would bear no realizable entity such that it exists before **d**$_1$ comes into being and that, if **d**$_1$ is realized in a process, then it is realized in the same process. As **clay**$_1$ at time t_1 (bearing **d**$_1$) is a material canonical artifact in our 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 is a canonical artifact if and only if it bears an intentional realizable entity whose realization of a "new" kind for the material entity which is the bearer — that is, a *novel intentional realizable entity*, which we define as "an intentional realizable entity

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[7] Note that, unlike **d**$_1$, **r**$_1$ can cease to exist even without its physical makeup being changed, in particular when **clay**$_1$ is no longer intended to be used to contain liquid.
[8] The term "intentional act" in this definition should be taken to be general enough to accommodate Borgo & Vieu's [12] notion of "mental selection".
[9] The term "the same process" in this definition refers to the same particular process. We leave for future work a meticulous analysis of the identity of processes in BFO (e.g. [15]).
[10] See our companion paper [8] for a more detailed analysis of the intentional and goal-directed dimensions of intentional realizable entities.

that is a novel realizable entity" [8]. Note that neither $\mathbf{r_1}^*$ nor $\mathbf{r_2}$ is a novel realizable entity, as we will explain in detail below.

2.3. Material usefact

In our companion 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 $\mathbf{clay_1}$ and $\mathbf{pebble_2}$:

- $\mathbf{clay_1}$ bears the disposition $\mathbf{d_1}^*$ to hold a door after time t_1 — note that, unlike $\mathbf{r_1}^*$, $\mathbf{d_1}^*$ 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 $\mathbf{clay_1}$ remains unchanged.
- $\mathbf{pebble_2}$ bears the disposition $\mathbf{d_2}$ to keep papers in place — note that, unlike $\mathbf{r_2}$, $\mathbf{d_2}$ 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 $\mathbf{pebble_2}$ remains unchanged.

We also introduce, following the companion work [8], the relation of "being non-novel because of" between two realizable entities as follows:

A realizable entity *r* is non-novel because of a realizable entity *r'*

$=_{\text{def.}}$ 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 $\mathbf{r_1}$, $\mathbf{r_1}^*$ and $\mathbf{r_2}$ as follows:

- Non-novel because of some novel intentional realizable entity
    a. the role $\mathbf{r_1}$ of $\mathbf{clay_1}$ is non-novel because of $\mathbf{d_1}$ (and $\mathbf{clay_1}$ at time t_1' is a material canonical artifact, but not a material usefact.)
- Non-novel because of some realizable entity that is not a novel intentional realizable entity
    a. the role $\mathbf{r_1}^*$ of $\mathbf{clay_1}$ is non-novel because of $\mathbf{d_1}^*$ (and $\mathbf{clay_1}$ at time t_1'' is both a material usefact and a material canonical artifact.)
    b. the role $\mathbf{r_2}$ of $\mathbf{pebble_2}$ is non-novel because of $\mathbf{d_2}$ (and $\mathbf{pebble_2}$ at time t_2 is a material usefact, but not a material canonical artifact.)

As $\mathbf{clay_1}$ at time t_1'' (bearing $\mathbf{r_1}^*$) and $\mathbf{pebble_2}$ at time t_2 (bearing $\mathbf{r_2}$) are material usefacts in our sense of the term in Section 2.1, we can define the term "material usefact" as follows:

material usefact $=_{\text{def.}}$ A material entity that bears an intentional realizable entity which is non-novel because 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 material canonical artifacts and material usefacts. Let us first consider artifactual functions of material canonical artifacts. Using our illustrative examples, $\mathbf{clay_1}$ at time t_1 is a material canonical artifact. Because $\mathbf{clay_1}$ at time t_1 bears $\mathbf{d_1}$, we may think of $\mathbf{d_1}$ 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 $=_{\text{def.}}$ 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, $\mathbf{d_1}$ is a novel intentional disposition and $\mathbf{clay_1}$ at time t_1 is a material canonical artifact.

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 [4,10,16]. 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.[11]

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 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 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], as BFO:functions are BFO: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

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[11] For some pointers as to future inquiry, see Koslicki's [17] and Koslicki & Massin's [18] discussion on malfunctioning

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) and **pebble**$_2$ at time t_2 (when it is intended to be used to hold papers) are material usefacts. As **clay**$_1$ at time t_1'' bears $\mathbf{r_1}^*$ and **pebble**$_2$ at time t_2 bears $\mathbf{r_2}$, one possible interpretation (which we will scrutinize below, though) is to regard $\mathbf{r_1}^*$ and $\mathbf{r_2}$ as artifactual functions of material usefacts. To generalize this idea, we can introduce the term "usefactual realizable entity" as follows:

> usefactual realizable entity $=_{\text{def.}}$ An intentional realizable entity (i) of an independent continuant (ii) which is non-novel because 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 [14] notion of "broad use function"). For instance, $\mathbf{r_1}^*$ and $\mathbf{r_2}$ are usefactual realizable entities borne by material usefacts, and thus they might be called "artifactual functions".[12]

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]. Here, 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 artifactual functions of material usefacts.[13]

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 will 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:

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[12] 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 on roles in BFO, see Röhl & Jansen [4] and Toyoshima et al. [12].

[13] As we argued in the companion work [8], our notion of usefact is related with the anthoropological notion of naturefact [19].

> 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 <u>is used</u> as a mortar, it seems it <u>has a function</u>, 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 our realizable-based analysis thereof:

- 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 [20] notion of "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 fullfilment) at time t_1''', as a mean of holding a door. Then, I am justified in ascribing holding a door 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 within the BFO framework, 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 [14] notion of "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" [14, 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 $=_{\text{def.}}$ 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 uniformally characterized as realizable entities, whether they are novel intentional dispostions (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 (by definition) being realized; but a novel intentional disposition (and also a usefactual realizable entity) can go unrealized.[14]

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:

> design BFO:function $=_{\text{def.}}$ 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 design BFO:function seems to assume the non-continuity view of diachronic identity. To see why, recall our analysis of the example of a pot made of an amount of clay which is intentionally shaped and dried at time t_1, 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 $\mathbf{clay_1}$ comes to instantiate the kind *Pot*.
- $\mathbf{clay_1}$ comes to bear the disposition $\mathbf{d_1}$ to contain liquid, at time t_1.

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[14] Cf. [4,10] for the view that the notion of a realizable entity helps to distinguish between "functions" (continuants) and "functionings" (occurrents). Moreover, 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]

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), since $\mathbf{clay_1}$ does not come into being at time t_1. By assuming the non-continuity 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 dispositon (and $\mathbf{pot_0}$ is thus a material canonical artifact). In particular, $\mathbf{f_0}$ is "trivially novel", which was a notion presented in our companion work [8]: 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.

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 whether the continuity view or the non-continuity view is adopted, our notion of novel intentional disposition would be more general than the notion of design BFO:function, although we leave for future work the non-continuity-based reformulation 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]*

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, given laws of nature in our actual world.

To analyze amulets and sacrificed animals, it will be helpful to consider Koslicki & Massin's [21] notion of "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.[15] 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 "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.[16] It will be therefore valuable to formalize faith-based artifacts and placebo capacities within our realizable-centered framework for artifacts.[17]

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.[18]

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[15] See also Koslicki & Massin's [18] discussion about different theories of functions with regard to artifacts.

[16] In more detail, we can think that placebo capacities are novel intentional realizable entities that are not BFO:dispositions, based on the hypothesis that they are "intentional" realizable entities in the sense of existing in virtue of some relevant belief and desire, rather than in virtue of some relevant intention. We will leave for future work the justification of this hypothesis on the intentional dimension of intentional realizable entities.

[17] Moreover, 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". Arguably, 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. Insofar as faith-based artifacts can be generally understood as a kind of canonical artifacts, a detailed ontological analysis of such abstract artifacts may be provided through the extension of our realizable-based characterization of canonical artifacts to the category of abstract artifacts. See our companion paper [8] for pointers into such extension.

[18] See also Koslicki & Massin's [18] criticism of what they call "functionalism about artifact kinds".

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 companion work [8], based on Basic Formal Ontology (BFO). The result is that artifactual functions of material canonical artifacts and material usefacts can be analyzed, respectively, as novel intentional dispositions and usefactual realized entities.[19] One important consequence of this analysis is that having an artifactual function implies being an artifact, but not *vice versa*. In future work we will investigate the comparison of our approach to artifactual functions with existing major theories of functions [3,4] (including design, proper/etiological and systemic theories, as examined in the work [18]) and a realizable-based formalization of faith-based artifacts and placebo capacities.[20]

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[19] Recall that examples of novel intentional dispositions include $\mathbf{d_1}$ borne by $\mathbf{clay_1}$ at time t_1 under the continuity view, as well as the design BFO:function $\mathbf{f_0}$ borne by $\mathbf{pot_0}$ under the non-continuity view; and that examples of usefactual realized entities include the realized role $\mathbf{r_1}$* to hold a door that is borne by $\mathbf{clay_1}$ at time t_1''' and the realized role $\mathbf{r_2}$ to keep papers in place that is borne by $\mathbf{pebble_2}$ at time t_2'.

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