Architecture, Design and Conservation
Danish Portal for Artistic and Scientific Research

Aarhus School of Architecture // Design School Kolding // Royal Danish Academy

Science and design revisited

Galle, Per; Kroes, Peter

Published in:
Design Studies

DOI:
10.1016/j.destud.2014.12.005

Publication date:
2015

Document Version:
Peer reviewed version

Link to publication

Citation for pulished version (APA):
Galle, P., & Kroes, P. (2015). Science and design revisited. *Design Studies*.
https://doi.org/10.1016/j.destud.2014.12.005

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Download date: 24. Apr. 2024

ARKITEKTSKOLEN AARHUS Designskolen Kolding Det Kongelige Akademi

Manuscript title page (with author names)
Click here to view linked References

File: Science and design revisited - Title page with names v. 1.0.doc
Unpublished manuscript. 2014-09-28. Please do not cite without consent from the authors. [Amended 2015-01-13.]

HOW TO CITE THE PUBLISHED VERSION OF THIS PAPER: see DOI at the bottom of this page.

Science and design revisited

Per Galle, The Royal Danish Academy of Fine Arts, School of Design, Philip de Langes Allé 10, DK-1435 Copenhagen K, Denmark

Peter Kroes, Department of Philosophy, Faculty of Technology, Policy and Management, Delft University of Technology, Jaffalaan 5, Nl-2628 BX Delft, The Netherlands

Corresponding author: Per Galle. Email: pga@kadk.dk. Telephone: (+45) 20661223. Fax: n/a.

[*Abstract*, max. 120 words.] [Not available. Not required for 'Short communication'.]

Keywords: artefact, design methodology, design theory, epistemology, philosophy of design.

[Abstract added in proof:]

In 2012, Robert Farrell and Cliff Hooker published a paper in Design Studies, arguing against the conventional science–design distinction. Finding their position highly controversial, we opposed it in a paper of our own, to which Farrell and Hooker have now responded with a defence of their view. On request from the Editors, we seek in this paper to round off the dispute. We see it not so much in terms of who was right or wrong about what, as in terms of where our opponents and we may have been talking past each other. We also sum up some insights that the dispute has brought forward, while acknowledging the disagreements that no doubt remain.
[Word count: 115.]

Paper accepted 2014-11-13 for Design Studies. This document is the authors' accepted manuscript, including all revisions resulting from peer review, but no changes caused by subsequent processing by the publisher. It is made available under the terms of Elsevier's Journal Publishing Agreement (as retrieved 2013-12-18 from http://authors.elsevier.com/OCTAgreement.html) concerning 'Retention of rights for scholarly purposes', according to which terms the following notice is mandatory: 'NOTICE: this is the authors' version of a work that was accepted for publication in Design Studies. Changes resulting from the publishing process, such as peer review, editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. Changes may have been made to this work since it was submitted for publication. A definitive version was subsequently published in Design Studies, Vol.36 (2015). DOI: http://dx.doi.org/10.1016/j.destud.2014.12.003'

***Research Highlights**

Science and design revisited

Highlights (dummy file): No highlights required for a ‘Short Communication’.

*Manuscript (without author names)
Click here to view linked References

Science and design revisited

Table of Contents [for editorial use]:

Science and design revisited 1

[0. Introduction] 1

1. What of Farrell & Hooker's two 'complaints'? 2

2. Have we been talking past each other? 3

3. Are the cognitive processes like cats and dogs – or rather like a mature oak? 6

4. Concluding remarks 7

References 8

Science and design revisited

[0. Introduction]

In a refreshingly provocative paper, Farrell & Hooker (2012) attacked the conventional view that 'design and science are distinct types of intellectual study and production' (p. 481), arguing

(1) that 'science and design are *not in principle distinct*' (2012, p. 487, emphasis added),

(2) that 'design and science […] are most accurately represented, cognitively, as design processes' (2012, p. 494), and

(3) that 'both design and science use design processes and reasoning strategies to produce artificial objects, therefore, they are *not different in kind*' (2012, p. 494, emphasis added).

In addition, they challenged 'those who still want to distinguish design and science' to 'show a plausible conception [of design] that does not include science' (Farrell & Hooker, 2012, p. 490).

We for our part were, and are, not prepared to give up the conventional distinction between science and design, which we found, and find, conceptually useful. Therefore, in a recent paper (Galle & Kroes, 2014) we rose to Farrell & Hooker's challenge by proposing such a conception of design, while arguing for its plausibility. We also defended the conventional distinction by explaining why Farrell & Hooker's arguments against it did not persuade us, and by putting forward some arguments of our own to support it.

Farrell & Hooker have now taken this debate a step further by publishing a response to us (this issue) in which they elaborate on their views on the science-design relationship, using a thorough and critical analysis of our paper as a vehicle. The editors of *Design Studies* have asked us, in turn, to close the exchange by briefly commenting on Farrell & Hooker's response. We are grateful for this opportunity to revisit the science-design relationship.

The overall subject matter that has been under debate is non-trivial and many-facetted: how to characterize and understand design, as compared to science. It is non-trivial in many respects (e.g.,

the answer given may have far-reaching consequences for how to set up design and science curricula) and many-facetted because each of the terms 'design' and 'science' has many different meanings of its own. Because of the many-facetted nature of the topic under discussion it is easy to get lost in details and to get confused about the precise claims that are being put forward. In our opinion that is exactly what is the case in our exchange of ideas with Farrell & Hooker. So rather than discussing the details of the issues that Farrell & Hooker raise, we will concentrate on the larger picture, reflecting on *the debate* so far as a whole, seeking thereby to tie up some loose ends that we see in it, and which might otherwise puzzle our readers or cause confusion. By this we hope, if only indirectly, to provide some additional clarification of the subject matter itself.

1. What of Farrell & Hooker's two 'complaints'?

In section 1 of Farrell & Hooker's response paper (this issue) they make two 'complaints', each of which seems to concern some glitch in communication or misunderstanding that we would like to set straight.

According to the *first complaint*, we 'persistently read' their discussion in (Farrell & Hooker, 2012) of the so-called Simon-Kroes conception of artefacts as if they themselves endorsed that conception. We are not aware of having implied such endorsement on their part. If anything in our paper (Galle & Kroes, 2014) left that impression, it was certainly unintended. We ourselves remained neutral in regard to the Simon-Kroes conception of artefacts, so as far as our debate is concerned, we regard this as a non-issue.

According to the *second complaint*, we 'misread' Farrell & Hooker's argument by restricting our analysis of it to deductive logic, while in fact it is about 'judging onus of proof'. Furthermore, in doing so, they say, we 'also illustrate the implicit assumption that deductive logic is the appropriate, indeed only, standard of analysis, the very presumption that lay behind the flawed empiricist non-strategic conception of science' etc.

Whatever Farrell & Hooker may mean by 'illustrate' here, we used principles of deductive logic in our analysis, in order to show that their conclusion did not follow from their premises by a deductively valid argument – hence that it left room for our counter-argumentation. This does not commit us to any particular conception of science (flawed or not, as the case may be).

Like Farrell & Hooker, we are aware that in practical reasoning on complex matters, in science and elsewhere, one can seldom if ever proceed by deduction alone; other forms of reasoning may

be called for, such as 'inference to the best explanation' (see e.g. Groarke, 2013). But that does not mean that one must forfeit analysis and critique in terms of validity of the arguments under discussion.

Apart from issues about validity of arguments, there are issues about the nature of the premises on which to base conclusions, when the bone of contention is the characterization of science and design as similar or distinct. Both sides in the debate may appeal to different kinds of evidence or may interpret the same kind of evidence in very different ways. We do not expect that it will be possible to come up with evidence and arguments that settle this matter once and for all.

Farrell & Hooker's second complaint also mentions the 'onus of proof'. With regard to the claim that science and design are *cognitively* different, they want to put it on us ('the onus of proof remains on those affirming deep difference' in their section 3.). However, it has never been our aim to take a position in a debate specifically on cognitive differences; neither in (Kroes, 2002) nor in (Galle & Kroes, 2014). Our main aim in the latter paper was to argue against Farrell & Hooker's claim that there is no significant difference between the *products* of design and science. We argued that those products *are* significantly different, and we suggested that this might imply cognitive differences as well. Farrell & Hooker, on the other hand, seem to make a definite claim about the cognitive identity of design and science and so the onus of proof in this respect falls onto them.

2. *Have we been talking past each other?*

This dispute about the onus of proof raises the issue whether we have been talking past each other. Reading Farrell & Hooker's response leaves little doubt that their focus is on the position that in their opening paragraphs they introduce as 'Core Cognitive Commonality [CCC]'. That is, the thesis that

(4) 'it is reasonable to view [design and science] as sharing a common core cognitive process'.

For, as they say later in their introduction:

(5) 'We are interested in the problem-solving methods/processes involved [in design and science] and suspect they are the same general kind when abstracted from their immediate detail, however beguiling may be the particularities of their applications in each domain. This is what CCC asserts.'

In the core sections (two through five) of their response paper they deliver a passionate defence of CCC, most of which aims at showing that in our paper (Galle & Kroes, 2014) we failed at 'refuting CCC', or failed to 'throw CCC into doubt'. It is not our intention here to endorse or criticize their defence of CCC. As it happens, we tend to think that they are right that we failed to refute CCC or to throw it into doubt. But if we so failed, it is because refuting CCC, or throwing it into doubt, was not what we aimed at in the first place.

Granted, we did argue that there might be some ways in which design and science differ with respect to their underlying cognitive processes (particularly in our section 3.6, 'Methodological distinctions', *op. cit.* pp. 224-226). But even if (as we believe, and Farrell & Hooker doubt) we were right about that, it would hardly amount to a refutation of CCC.

Of course that depends on what exactly CCC stands for: If it means, as might be suggested by (4), that there is but a single 'common core cognitive process' that is shared by design and science, then indeed the differences we suggested would be incompatible with CCC, and our arguing for the differences could be construed as an attempt to refute CCC, or throw it into doubt. But if CCC means, as more plausibly suggested by (5), that the methods/processes employed in design and science are merely of the same general *kind*, then the 'methodological distinctions' we made in our paper would seem to sit quite comfortably within a context of CCC.

This being as it may, CCC was not our concern; CCC was not what we saw as Farrell & Hooker's position, contentious or not. In their paper to which we initially reacted (Farrell & Hooker, 2012), CCC was not mentioned, although some related ideas were at work. In addition to the explicit challenge to offer a plausible conception of design to set it apart from science, what particularly triggered us in that paper was (what we perceived as) Farrell & Hooker's idea of science and design as virtually indistinguishable; see again quotations (1), (2), and (3) above. The claim inherent in them [highlighted by us in (1) and (3)], that science and design are '*not in principle distinct*' and '*not different in kind*' is what we referred to as '*Farrell & Hooker's thesis of unification*' (Galle & Kroes, 2014, p. 204). This thesis of unification and their main argument for it, namely that design and science produce the same kind of products, was our concern.

The thesis of unification is *not* the same as CCC, as we interpret it. *Our focus* in (Galle & Kroes, 2014) was on Farrell & Hooker's *thesis of unification*. Whatever *their focus* was in their initial paper (Farrell & Hooker, 2012), it now seems to be on *CCC* (Farrell & Hooker, this issue). So when (as it seems to us) Farrell & Hooker now respond to our criticism of their thesis of

unification by defending *another* thesis, CCC, against an attack we did not make on it, readers *are* entitled to some confusion.

Assuming that in this manner Farrell & Hooker and we have been talking past each other to some extent, let us try to unravel the causes and see if we can dispel whatever confusion may have ensued.

In their claim (2), Farrell & Hooker suggest that design and science be 'most accurately represented, *cognitively*, as design processes' (emphasis added). Perhaps the fact that we also contested claim (2) – as part of our effort to refute the thesis of unification – goes some way to explain why Farrell & Hooker may have read our paper as (mainly?) an attack on CCC, although to us cognitive differences were not a main issue.

Furthermore, in section 3 of their response paper, they quote the following passage from our paper:

> 'If indeed a good scientist does not make a good designer and vice versa, then there is reason to assume that from a methodological point of view *the skills and competencies* that scientists and designers make use of in intelligent problem solving are different.' (Galle & Kroes, 2014, p. 214, emphasis added),

after which they argue that the consequent does not follow from the antecedent. The point relevant for us to make here, however, is that the highlighted passage might have led Farrell & Hooker to think that what we wanted to claim was a total difference in all skills and competences. We might as well have written '*some* skills and competencies' – and probably we should. This would still have allowed us to make our point, but it would have left open the possibility that *some* skills and competencies were the same in science and design, while others were different.

And that latter view, *which we do not want to challenge*, seems quite compatible with CCC. Had we been more clear on this, probably Farrell & Hooker would not have read our paper as an attack on CCC, and there would be no reason for them, as they write, to 'remain puzzled as to why Galle and Kroes seemed to have overlooked so obvious a possibility': viz. that science and design can differ with respect to their purpose, as we argued, while CCC can be maintained (Farrell & Hooker, this issue, beginning of section 3). – But, as already noted, CCC was not on the agenda at the time of our previous paper.

3. Are the cognitive processes like cats and dogs – or rather like a mature oak?

Farrell & Hooker compare the relation between design and science with the relation between cats and dogs. Superficially cats and dogs may appear 'to be thoroughly different kinds of creatures, yet they share in common an underlying mammalian nature, including basic skeletal "bau-plan", organ types, sensory structures, etc.' (the introduction to Farrell & Hooker, this issue). And again: 'Good dogs would not make good cats and vice versa, but from this nothing follows about their differing in mammalian nature' (*ibid*. section 3). The general idea seems to be that just as dogs and cats are superficially different but share the same mammalian nature, so science and design may be superficially different but share the same 'problem-solving (i.e. cognitive) processes'.

This is an interesting analogy. But if it is works for cats and dogs corresponding to design and science as problem solving practices, it also works for all mammals, including dolphins, ~~wales~~ whales, rats, elephants, ~~etcetera~~ etc., where these other mammals correspond to other kinds of human problem solving practices. If the analogy were pushed this way (and we see no reason why it couldn't be, since all mammals share the same mammalian nature), the claim about shared cognitive processes would be true for *all* human problem solving practices. [Popper's 'All life is problem-solving' once again (Galle & Kroes, 2014, p. 227).] We have no intention of arguing against such a strong claim. Suffice it here to remark that this line of analogical reasoning puts Farrell & Hooker's CCC thesis in a very different light: it is no longer a thesis specifically about design and science as problem solving practices but a thesis about all problem solving practices. Therefore, appealing, by way of analogy, to a single underlying 'mammalian nature' of cats and dogs may not be very effective as a defence of CCC if the latter is understood to be a thesis particularly about design and science.

But elsewhere in section 3, Farrell & Hooker make a convincing observation that we would like to acknowledge: After having refused to accept our argument that if 'a good scientist does not make a good designer and vice versa, then there is reason to assume that […] the skills and competencies that [they] make use of […] are different', they observe that '[a]rchitectural and engineering software designers can't be simply swapped either' and that, in general, *within* the design disciplines '[p]ractices are typically so saturated in their contextual details […] that people cannot easily shift between them'. And the same goes for practices *within* the disciplines of science.

This suggests an alternative analogy, which captures an understanding of CCC that might be as acceptable to Farrell & Hooker as it seems to us. Let us compare human problem solving in its entirety with a large, richly branching tree; say, a mature oak. If *experience* is counted as

constitutive of a person's or community's repertoire of problem solving skills and competences, it seems very plausible that a gradual specialization is going on all the way from a massive 'trunk' of fundamental problem solving skills and competencies shared by all human beings, over the hefty 'boughs' of skills and competencies shared by members of major disciplines such as science and design; and further on, into the finer branches of skills and competencies belonging to the more specialized disciplines, such as furniture designers or solid-state physicists – until finally we reach the 'twigs' of unique problem solving skills and competencies possessed only by individuals.

What the oak metaphor would suggest, is that whether design and science are considered similar or distinct in regard to their cognitive processes of problem solving, depends on what level of specialization one focuses on.

4. Concluding remarks

In closing this debate we would like to comment on the following quote from Farrell & Hooker's response (this issue, section 4), because it allows us to reiterate what has been our main concern in this debate, namely to defend the claim that the products of design and science are different:

> 'The Higg's boson, brought up by Galle and Kroes, is another case in point: the Higg's boson does not exist anywhere independently; rather it was literally made at CERN. It is an object previously only theorised about, that was constructed according to the "blueprint" provided by theory.'

Indeed, the Higg's boson was literally made at CERN and may be considered a product of science. However, as a product of science it is in a crucial sense different from a designed artefact, such as a bicycle. None of the properties of the Higg's boson made at CERN is the result of a design decision of its makers. If anywhere in the universe a Higg's boson exists 'independently' (why are Farrell & Hooker so sure that this is not the case?) then it shares all of its (intrinsic) properties with that made at CERN. If the Higg's boson produced at CERN turns out to have properties that are not in accordance with its theoretical blueprint, then the latter will have to be adapted. In science the mind-to-world fit reigns supreme. In design just the opposite is the case: if an object is a poor realization of an artefact-proposal, the object is to be adapted such that it becomes a good realization of the proposal. Here the world-to-mind fit is dominant. The crucial difference between the Higg's boson of the CERN and the bicycle is that, although both are made by human beings, only the bicycle is truly a human invention and thus a product of the human mind (Kroes, 2003,

2012). This difference is reflected in the fact that the Higg's boson is not eligible for a patent whereas a (new proposal for a) bicycle is. Whether this difference in the products of science and design has any implications for the core cognitive commonality (CCC) thesis is another matter.

We do not expect this argument to convince Farrell & Hooker; it is a last attempt on our part to make clear what in our opinion has been mainly at stake in the debate. Yet we hope that Farrell & Hooker share our contention that the debate, as documented in the three papers cited and the present commentary, has been fruitful, despite its undeniable difficulty. We feel that the sustained attempts made by both sides at understanding, criticizing, and sharpening each other's views on design as compared to science, have been conducive to a deeper understanding of that complex relationship. And last but not least, we hope that our readers, too, may find some inspiration in contemplating the outcome.

References

Farrell, R., & Hooker, C. (2012). The Simon—Kroes model of technical artifacts and the distinction between science and design. *Design Studies, 33*(5), 480-495. doi: http://dx.doi.org/10.1016/j.destud.2012.05.001

Farrell, R., & Hooker, C. (this issue). Designing and sciencing: response to Galle and Kroes. *Design Studies*.

Galle, P., & Kroes, P. (2014). Science and design. Identical twins? *Design Studies, 35*(3), 201-231. doi: http://dx.doi.org/10.1016/j.destud.2013.12.002

Groarke, L. (2013). Informal Logic. *The Stanford Encyclopedia of Philosophy (Spring 2013 Edition)*, from http://plato.stanford.edu/archives/spr2013/entries/logic-informal/

Kroes, P. (2002). Design methodology and the nature of technical artefacts. *Design Studies*, *23*(3), 287-302. doi: 10.1016/S0142-694X(01)00039-4

Kroes, P. (2003). Physics, experiments and the concept of nature. In H. Radder (Ed.), *The philosophy of scientific experimentation* (pp. 68-86). Pittsburgh: University of Pittsburgh Press.

Kroes, P. (2012). *Technical artefacts: creations of mind and mater*. Dordrecht: Springer.