A "Time-Slice" Approach to Tort Law's Component Parts Problem

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If you don’t like my peaches, baby, why do you shake my tree?

INTRODUCTION

Law, as it appears, usually does not need philosophy to solve its problems. Lawyers articulate opposing interests, and the judge or appellate panel decides the particular controversy, aware that future legal actors will draw general principles from the outcome. Legal precedents and public policy will frame both the debate and the decision.

At the same time, because judges are intellectually variegated beings, other disciplines are always latent in legal decision-making. Once in a while, the court will rely explicitly on a nonlegal discipline, such as philosophy. This usually happens when the issue addressed is one of first impression in the strong sense. Cases of strong first impression most likely surface when there has been a shift in the relevant cultural or social landscape that has disoriented the court to some extent. A case of first impression arises in the weak sense however, when no prior decision in the controlling jurisdiction is quite on point,

1. The author is an appellate lawyer, and a doctoral student in philosophy at the Graduate Center of the City University of New York. He thanks Stephen Grover for his patient instruction and invaluable comments on the manuscript, Jaegwon Kim, Michael Levin and Arnulf Zweig for their kind teaching in areas relevant to this paper, Catherine A. Roberts for sharing analogies in applied mathematics, and Gina Gabriella Schmeling.


4. See e.g., Brown v. Board of Education, 347 U.S. 483 (1954) (using nonlegal authorities in rejecting the prior doctrine that separate but equal educational facilities affords equal and sufficient treatment to different racial groups); Roe v. Wade, 410 U.S. 113 (1973) (noting, inter alia, Plato's, Aristotle's, St. Augustine's and Bracton's views on abortion in fashioning a novel constitutional doctrine).
but "persuasive analogies and principles applied in cases not readily
distinguishable from this are to be considered." 5

The component parts issue in tort law is only one of first impression
in the weak sense, but it still will be an issue of first impression in most
states. Because the courts can and will eventually address the prob-
lem in the usual way, inferring from precedents and policy concerns,
they will not explicitly incorporate any philosophy. To the extent that
there is a closely analogous issue in philosophy, elegant approaches in
that discipline will give an extralegal basis for evaluating the law's res-
olution in hindsight. Conversely, law's resolution should inform the
"common sense" and "pragmatic" impulses that often motivate phi-
losophy. 6 If solutions in the respective disciplines diverge, there will
be latent and destabilizing tensions in each; however, if the good solu-
tions are in accord, one discipline will tend to stabilize the other.

So, what is the component parts problem in tort law? In one scena-
rio, company D sells its product, which contains "unreasonably dan-
gerous" and hence, some "defective" component parts. 7 The product
is an injector or oil lubricator pump designed for battleships, and the
dangerous parts are its asbestos-containing gaskets. After some time,
the gaskets wear out and the buyer, the Navy, installs replacement
gaskets manufactured and supplied by an otherwise unknown com-
pany, called not-D. The replacement gaskets also contain asbestos
and are not observably different from the original parts. Some time
later, worker A, who is repairing battleships, is exposed to asbestos
fibers released from the replacement gaskets, and this causes his lung
cancer and eventual death. When A's estate sues, D's defense is that
the injurious product is not the same product that D sold. 8

A metaphysical question is whether the pump that harmed A is the
same pump that D sold to the Navy. If the pump is a persisting thing,
then what does its persistence consist in? Is the pump at the time of

6. See e.g., Paul Grice, Postwar Oxford Philosophy in Studies in the Way of Words
7. Traditionally, a "defective" product is one that, when it leaves the seller's hands, is
capable of harming an ordinary user in a way he would not reasonably foresee. Restatement
(Second) of Torts § 402A, cmt. I (1965).
8. For background doctrinal reading on tort law's component parts issue, see generally Rich-
ard C. Ausness, Learned Intermediaries and Sophisticated Users: Encouraging the Use of Inter-
mediaries to Transmit Product Safety Information, 46 Syracuse L. Rev. 1185 (1996); Michael
B. Gallub, Limiting the Manufacturer's Duty for Subsequent Product Alteration:
Three Steps to a Rational Approach, 16 Hofstra L. Rev. 361 (1988); M. Stuart Madden, Com-
ponent Parts and Raw Materials Sellers: from the Titanic to the New Restatement, 26 N. Ky. L.
Rev. 535 (1999); Edward M. Mansfield, Reflections on Current Limits on Component and Raw
sale and at the time of A’s exposure parts of a unified whole? Is there something that the pump is that does not change through time? Is there some sort of substratum that allows the pump to retain its identity even though its parts, and sometimes its properties, are changed or replaced? Is this essentially a question of being able to point to the pump at the time of sale and at the time of exposure to affirm its identity, or perhaps at least the historical unity of the identified objects?

Rhetorically speaking, A’s estate advances if it can convince the court that the thing D sold and the thing that harmed A are “the same,” even if they are not strictly identical. But A’s estate does not necessarily win on that ground. The plaintiff still must show that the product D sold was defective, and that this defect was a substantial contributing factor in causing A’s injury. Even if the pump’s persistence through time evidences a causal nexus, this nexus might not be strong enough to prove that D’s misconduct was a substantial contributing factor. Maybe the pump persists in “fusion” with the replacement gaskets, but the replacement has intervened to deprive D’s actions of substantial causal effect.

On the other hand, it is possible that the defect at the time of sale could be causally linked to the injurious exposure even if the pump at both times is deemed to be two different, non-identical, and non-persisting things. This sort of causal connection would likely be considered too weak or remote to be proximate and A’s estate would probably lose under that scenario. For example, consider the marketing of a generic, albeit dangerous, drug patterned after Manufacturer X’s design. X’s behavior would supply a link in the but for chain of causation, but it would be too remote to engender liability for harm resulting from a plaintiff’s ingestion of the generic product.

9. Caruolo v. John Crane, Inc., 226 F.3d 46 (2d Cir. 2000); Resolution Trust Corp. v. Fidelity & Deposit Co. at Maryland, 205 F.3d 615, 656 (3d Cir. 2000).
10. See generally Atchison, Topeka & Santa Fe R.R. Co. v. Calhoun, 213 U.S. 1 (1909) (saying “the law, in its practical administration, . . . regards only proximate or immediate and not remote causes, and in ascertaining which is proximate and which remote refuses to indulge in metaphysical niceties. Where, in the sequence of events between the original default and the final mischief an entirely independent and unrelated cause intervenes, and is of itself sufficient to stand as the cause of the mischief, the second cause is ordinarily regarded as the proximate cause and the other as the remote cause”); Peters v. The Warren Ins. Co., 39 U.S. 99 (1840) (similarly noting that “[i]f these questions are to be settled rather by the common sense than by the metaphysics of the law, then it would seem to be clear, that the collision here is . . . not the proximate cause, for that is proximate which lies nearest; and here another cause is interposed, and thus lies nearer”); Barati v. Aero Indus., Inc., 579 So.2d 176, 178 (Fla. Dist. Ct. 1991) (saying there is no proximate cause if the range of danger is too remote to be reasonably foreseeable, or there is an independent cause that breaks the chain of causation).
These legal and philosophical issues interweave with considerations of relevance as the main interdisciplinary constraint. On the other hand, influential legal thinkers claim that law and philosophy speak such different languages that juxtaposing the disciplines is ill-advised, either because "the natural affinity of law is... not with the abstract, conceptual, and theoretical" or because the theoretical is irrelevant to law's practical concerns. It is true that law's concerns, in immediately solving practical controversies and setting good policy, are not usually philosophy's concerns. But legal doctrines developed in metaphysics' penumbra carry more currency and bring reason to law, if the metaphysics they imply is sound.

This essay bypasses the familiar strictures against any claim that what is legal is philosophical. Part II refers to a small group of interesting legal decisions addressing aspects of the component parts problem. Part III favors the "time-slice" or "four-dimensionalist" approach initiated by Willard Van Orman Quine. The general claim is that the injector pump that D sold in the previous example persisted through the time of A's harmful exposure. If that is true, philosophy may neatly support, and possibly clarify, legal policy. Part IV further supports this claim by arguing that any artifact's persistence consists of the causal bond between its temporal phases. It is here where law may contribute reciprocally to philosophy, and this section critiques Wesley Salmon's promising propagation theory of causation.

II. LEGAL CASES INVOLVING THE COMPONENT PARTS PROBLEM

D says that even if it did something wrong, its misconduct could not have caused A's injury. The asbestos gaskets to which A was exposed were replacement parts made and sold by not-D. Regardless of whether the Navy replaced the gaskets two years or even two days after purchase, D may escape liability for all post-replacement exposure.

14. Asbestos is a white or light gray natural mineral, obtained by mining actinolite and amphibole, and occurring in long slender needles or fibrous masses that historically has been woven into acid-resisting, nonconductor, and fireproof products. As early as 1935, asbestos was widely recognized as a mortal threat affecting a large proportion of those workers who had regularly come in contact with the material. Because most asbestos materials are highly friable (readily crumbled), the fibers are easily airborne and consequently may be inhaled, often resulting in
In most courts, D will not win. In one significant case, Welch v. Dura-Wound, Inc.,15 Dura-Wound manufactured a machine for molding fiberglass pipes. It sold the machine to an intermediary that "made no modifications," but added some component parts for which the machine was designed.16 The issue was whether Dura-Wound was liable for defects in those parts. The court held that a company is responsible for harm caused by replacement or accessory parts if the product was "purposefully designed" to accept those parts, unless the additional parts substantially modify the product.17

This, of course, does not mean that the intermediary and the manufacturer of the added parts are not responsible; liability is jointly imposed. The important point is that Dura-Wound's liability must be predicated on a causal connection. The idea of "purposeful design" carries causal power sufficient to be a proximate cause. If there is a hidden metaphysical premise in Welch, it might be that Dura-Wound's machine persisted through its combination or "fusion" with additional component parts. What bonded this persisting thing through its temporal phases was the causal power inherent in the purposeful product design. This article contends that this purposefulness, which shaped the product during its earliest phase, was somehow projected onto the product in its later phases.

Alternatively, one could contend that a philosophical notion of temporal persistence is gratuitous in the context of legal thinking, due to the multiplying of entities beyond necessity.18 The law's plainspoken

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16. Id. at 77.
17. Id. at 78; see also Hart v. Hytrol Conveyor Co. Inc., 823 F. Supp. 87, 93 (N.D.N.Y. 1993) (saying unless "replacement lagging modified the design" of the product, the harm caused by that replacement part is defendant's responsibility); Feuerverger v. Hobart Corp., 738 F. Supp. 76, 77-79 (E.D.N.Y. 1990) (holding that the defendant was liable for injury caused by its commercial food mixer, although it didn't make or sell the defective part, because it "purposefully designed the Mixer to accept various accessories, including the Attachment"); Denny v. Ford Motor Co., 662 N.E.2d 730, 735 n.3 (1995) (ruling that liability "arises from an intentional decision by the manufacturer to configure the product in a particular way"); Kimble v. East Chicago Tool Corp., 1995 U.S. Dist. LEXIS 3659, at *11 (S.D. Ala. Mar. 17, 1995) (manufacturer will be deemed liable "where the necessity of the replacement parts... was foreseeable [unless] the replacement part was so different from the original as to substantially increase the risk of injury to persons operating such machine"); Matera v. Catanzano, 161 A.D.2d 687 (N.Y. Sup. Ct. 1990) (saying manufacturer would be liable if product "was purposefully manufactured in order to facilitate the making of the alteration," unless defendant proves that harm "would not have happened had this alteration not been made").
policy preferences may be sufficiently explanatory. Perhaps, as Immanuel Kant objected to eighteenth century rationalist doctrines of the substantiality and persistence of the soul, one should realize that talk of things in similar terms says more than one has an epistemic right to say.\textsuperscript{19} The problem, however, is that if a product is a different thing after some alteration or addition, what is the causal vehicle linking the defendant's original misconduct to the plaintiff's injuries? In law, "[p]roof of negligence in the air, so to speak, will not do."\textsuperscript{20} Therefore, the idea of the hidden premise, that Dura-Wound's machine persisted, seems sustainable.

In another interesting decision, \textit{Morris v. American Motors Corp.},\textsuperscript{21} the court ruled that an original manufacturer is liable for any defective replacement component part that "was an integral part" of the product, and opined that the buyer "purchases a package that includes far more than the item delivered itself."\textsuperscript{22} This language is metaphysically vague because it supports contrasting, though not necessarily conflicting, views: that the item sold persisted and that some larger package also persisted. In other words, the replaced piece may be an integral part of the product purchased, in which case, the two have fused and the original item continues. Alternatively, the product plus replacement may amount to some bigger package that was originally purchased, and that package also continues. Either way, the court's view was that the original manufacturer's act before the sale can be proximately linked to the harm caused by the persisting thing. Thus, there is some sort of projection of the defendant's intent, or purposeful design, onto the later phase of the item or package.

A's estate would be pleased with the cases mentioned so far. D will be able to rely upon the sort of case that holds a manufacturer liable for another entity's component parts only when it personally installed them into its finished product. In one such case, \textit{Ford Motor Co. v.}

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\item \textsuperscript{19} \textit{Immanuel Kant, Critique of Pure Reason} 411-58 (A 341/B 399) (Paul Guyer & Allen W. Wood trans., eds., 1997) (1781/1787). Kant says, \textit{inter alia}, that "substance itself never can be thought by our understanding, however deep we may penetrate." \textit{Immanuel Kant, Prolegomena to Any Future Metaphysics That Can Qualify as a Science} 99 (Paul Carus trans., 1902) (1783). The qualification "by our understanding" is important, because elsewhere Kant explains that we can "think" of objects as things in themselves, but that's all we can do in regard to the noumenal world. Kant's distinction is between thinking, which can be of "whatever I like," and knowing and cognizing, which must be limited by the conditions of our "sensible intuition," \textit{Kant, Critique of Pure Reason, supra}, at 115 (B xxvi) which thus must be it is within the "bounds of experience." \textit{Id.} at 148 (B 23).
\item \textsuperscript{20} \textit{Palsgraf v. Long Island R.R. Co.}, 62 N.E. 99 (N.Y. 1928) (quoting \textit{Frederick Pollack, The Law of Torts} 455 (11th ed. 1920)).
\item \textsuperscript{21} 459 A.2d 968 (1982).
\item \textsuperscript{22} \textit{Id.} at 574-75.
\end{itemize}
Wood,\textsuperscript{23} the court's less interesting point was policy based. It found that when a manufacturer "assembles" a product, it benefits economically from the sale of the incorporated components and implicitly represents to the buyer and ultimate user that the product, including the components, is safe.\textsuperscript{24}

A more interesting rationale, taken from an earlier federal ruling, is worth quoting in relevant part:

"[I]f an assembler were strictly liable for an 'identical' replacement part purchased from a third party, the court would be forced to conduct an inquiry into whether the original and the replacement parts were manufactured by the same company. . . . If so, whether the original and replacement parts were sufficiently similar? . . . If so, whether the original and replacement parts were manufactured utilizing a similar process and similar materials? If so, at what point in time did endorsement by the assembler of the component manufacturer come to an end, if ever?"\textsuperscript{25}

If the \textit{Wood} and \textit{Exxon} language is interpreted philosophically, one might be warranted in saying that the harmful product was the same as the original product, but only if the new part was "identical" to the original. But as a practical matter, it simply would be too complex to establish that two different things, such as the original component and its replacement, were "identical." Of course, the court is speaking pragmatically, using the locution "\(a\) is identical with \(\beta\)" in a \textit{loose} sense, which is consistent with saying "Some things are true of \(a\) that are [not] true of \(\beta\)."\textsuperscript{26} Nor has the court's language anything to do with the Leibnizian doctrine of the identity of indiscernibles.\textsuperscript{27}

\begin{footnotesize}
\begin{enumerate}
\item 24. \textit{Id.} at 34.
\item 25. \textit{Id.} at 1331 (quoting \textit{Exxon Shipping Co. v. Pacific Resources, Inc.}, 789 F. Supp. 1521, 1527-28 (D. Hawaii 1991)); \textit{see also} \textit{Baughman v. General Motors Corp.}, 780 F.2d 1131, 1132-33 (4th Cir. 1986) (refusing to hold truck manufacturer liable for defective wheel rim it had not supplied or installed); \textit{Comstock v. General Motors Corp.}, 99 N.W.2d 627 (1959); \textit{Walton v. Harnischfeger}, 796 S.W.2d 225, 227-28 (Tex. App. 1990) (saying crane manufacturer had no duty to warn about rigging it had not made or incorporated into its crane); \textit{Newman v. General Motors Corp.}, 524 So.2d 207, 209 (La. App. 1988) (holding truck manufacturer was not liable for defective ratchet assembly it had not incorporated into its product); \textit{Spencer v. Ford Motor Co.}, 367 N.W.2d 393, 396 (Mich.App. 1985) (ruling vehicle manufacturer was not liable for defective wheel rim component added after sale).
\item 27. \textit{Gottfried Wilhelm Leibniz, 4 Die Philosophischen Schriften} 433 (L 308) (C. I. Gerhardt ed., 1965) (1857-90) (saying "[i]t is not true that two substances may be exactly alike and differ only numerically, \textit{solo numero}"); \textit{Gottfried Wilhelm Leibniz, 7 Die Philosophischen Schriften} 393 (L 700) (C. I. Gerhardt ed., 1965) (1857-90) (inferring from the principle of sufficient reason "that there are not in nature two real, absolute beings, indiscernible from each other").
\end{enumerate}
\end{footnotesize}
In any event, the court’s discussion of the “identity,” however loose the sense of the term, of the replacement parts begs the question of whether the product is the same as the product prior to the replacement of parts. For example, the water in the East River beneath the Brooklyn Bridge at \(t_1\) will not be the same water that is under it at \(t_2\); the question is really whether the river is the same.

In *Wood*, the plaintiff worked at a garage that fixed Ford vehicles. Ford’s brake and clutch linings contained up to sixty percent chrysotile asbestos by weight, but the brake and clutch parts at the garage were not the original parts and no witness in the case knew the manufacturer.\(^{28}\) Perhaps each Ford vehicle was a “‘being by aggregation’” or an “assemblage” of “material objects and not properly speaking a single material object in its own right.”\(^{29}\) Alternatively, each vehicle is most elegantly seen as a four-dimensional object, with any alteration in spatial parts being one signifier of a separate temporal phase. These sorts of questions are at issue, as well as such metaquestions as whether we are really dealing with ontological status, or rather with our special human interests in conceptualizing entities in certain ways.

No one, however, would deny that things discernibly different are not identical.\(^{30}\) Justice Benjamin Cardozo was correct about the notion of causality during the time Bertrand Russell was denouncing the notion as “a relic of a bygone age.”\(^{31}\) In *MacPherson v. Buick Motor Company*,\(^{32}\) Cardozo first noted that the defective component part, a wheel, was not made by the defendant, but was bought from another manufacturer.\(^{33}\) He said: (1) “If the nature of a thing is such that it is reasonably certain to place life and limb in peril when negligently made, it is then [‘persists as’] a thing of danger;”\(^{34}\) and (2) the manufacturer of


\(^{30}\) One factor skewing the purity of the analysis with respect to *Wood* is that, in that case, the verdict sheet asked the jury whether Wood was exposed to Ford’s asbestos-containing products, identified during trial as brake and clutch linings. Ford Motor Co. v. Wood, 703 A.2d 1315, 1330 (Md. Ct. Spec. App. 1998). Also, “[i]t was not until after the close of all the evidence, during a discussion of the jury verdict form, that Mrs. Wood articulated for the first time her theory that Ford’s duty to warn stemmed from its sale of the vehicles rather than its sale of brakes.” *Id.*

\(^{31}\) Bertrand Russell, *On The Notion of Cause, in Mysticism and Logic and Other Essays* 180 (1929) (1913).

\(^{32}\) 111 N.E. 1050, 1051-52 (1916).

\(^{33}\) *Id.* at 1051-52.

\(^{34}\) *Id.* at 1053.
the finished product cannot be relieved from liability unless the component part manufacturer's conduct is deemed to be "an independent cause [which] intervene[s]"\textsuperscript{35} to render defendant's conduct "too remote to constitute, as to the ultimate user, an actionable wrong."\textsuperscript{36} The following section offers a time-slice explanation of (1), and Part IV shows why (2)'s causal language makes sense in a way Cardozo would not have contemplated.

III. The Time-Slice Idea

Contractors built the Empire State Building from 1930 until 1931. Assume that workers fastened the final bolt on April 1, 1931, at \( t_0 \),\textsuperscript{37} and that in 1945, at time \( t_1 \), a B-25 bomber crashed into the 79th floor of the building. At \( t_2 \), workers completed repairs and replaced steel beams, concrete walls, and various other building parts. At \( t_3 \), in 1951, a television mast was placed on top of the building, increasing its height from 1,250 feet to 1,472 feet.\textsuperscript{38}

The Empire State Building has a certain three-dimensional profile at any particular time, so it has a certain historical profile along its fourth-dimensional temporal axis. As a thing in space, the building is different at different points, such as large at the base, narrow and pointy at the top, and so forth. And as a thing in time, it can be analogously varied, as previously shown, from one temporal phase to the next. In a space-time diagram, the building as a three-dimensional object would be an event represented by a point, but four-dimensionally, it would be a process represented by a line.\textsuperscript{39}

The idea of four-dimensionality is not traditional. While accepting that things may "endure" by being wholly present at more than one time,\textsuperscript{40} the familiar three-dimensional perspective has seemed to philosophers inconsistent with the view that things changing in time persist. Three dimensionalists tend to conclude that things do not survive a change of parts. Thomas Reid wrote:

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\item \textsuperscript{35} \textit{Id}. 1054.
\item \textsuperscript{36} The case has been most often cited for its rejection of Buick's privity claim that tort liability "grows out of contract and nothing else," and that the purchaser car dealer "was the one person whom it was under a legal duty to protect." \textit{Id}.
\item \textsuperscript{37} I choose to say the Empire State Building was completed then, rather than on May 1, 1931, when President Hoover pressed a button in Washington, D.C., officially opening the building and turning on its lights.
\item \textsuperscript{38} \textit{Empire State Building}, at http://www.esbnyc.com/html/history/html (visited on Nov. 16, 2000).
\item \textsuperscript{39} See Salmon, \textit{supra} note 13.
\item \textsuperscript{40} \textsc{David Lewis}, \textit{On the Plurality of Worlds} 202-03 (1986).
\end{itemize}
All bodies, as they consist of innumerable parts that may be disjoined from them by a great variety of causes, are subject to continual changes of their substance, increasing, diminishing, changing insensibly. When such alterations are gradual, because language could not afford a different name for every different state of such a changeable being, it retains the same name, and is considered as the same thing. Thus we say of an old regiment that it did such a thing a century ago, though there now is not a man alive who then belonged to it. We say a tree is the same in the seed-bed and in the forest. A ship of war, which has successively changed her anchors, her tackle, her sails, her masts, her planks, and her timbers, while she keeps the same name is the same.\textsuperscript{41}

Reid’s reference to “[a] ship of war” recalls the problem of the Ship of Theseus.\textsuperscript{42} For the purpose of this article, the story may be told this way: As an important artifact in their mythology, Athenians preserved Theseus’s ship along the Aegean. After a while, they replaced a plank. Over time, every plank and each anchor . . . was replaced. Meanwhile, a Cretan shipbuilder found and gathered the discarded parts and transported them to Iráklion. Although, he assembled (or reassembled) the entire ship, both the Cretans and the Athenians claimed to possess the Ship of Theseus.

It is not clear which way Reid decides the case. Philosophically, he leans toward the Cretans, but legally, he realizes that what the Athenians have “is considered as the same thing” through its gradual changes.\textsuperscript{43} That the Ship of Theseus “retains the same name” while in the Athenian’s continued possession seems a significant legal fact.\textsuperscript{44}

In short, Reid is conflicted, and conflicts between philosophical thinking and legal decision-making destabilize.

Important thinkers in Reid’s camp include Joseph Butler and his champion in this area, Roderick Chisholm. Chisholm’s two theses, adopted from Butler, are: (1) that artifacts and physical things, such as trees, ships, bodies and houses, being \textit{entia per alio}, generally persist “only in a loose and popular sense,” and (2) that persons, as \textit{entia per se}, persist “in a strict and philosophical sense.”\textsuperscript{45} This article refers to theorists such as Chisholm and Butler as dichotomists and their theory as the dichotomy view.

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\item \textsuperscript{42} Plato, \textit{Phaedo} 58\textsuperscript{a}, in \textit{Complete Works} 49, 50 (John M. Cooper and D.S. Hutchinson, eds. G.M.A. Grube trans., 1997).
\item \textsuperscript{43} \textit{Reid}, supra note 41, at 346.
\item \textsuperscript{44} \textit{Id}.
\item \textsuperscript{45} \textit{Chisholm}, supra note 26, at 277.
\end{itemize}
\end{footnotesize}
It is evident that for the dichotomy view to be valid, there must be criteria that establishes persistence in a strict, philosophical sense in the case of persons, which is absent in the non-person cases. Put differently, if the criterion that applies in the case of a strict continuant also applies in loose continuant cases, the supposed dichotomy fails.

So, what is it that holds people together as the same persons through time? The literature tends to divide according to whether bodily or psychological factors are emphasized, but sometimes they are combined. John Locke believed that people's memories provide them a special epistemic access to their pasts and allow each "intelligent Being [to] consider it self as it self, the same thinking thing, in different times and places." Joseph Butler, who thought kindly of souls, said Locke's view was fallacious because "consciousness of personal identity presupposes, and therefore, cannot constitute, personal identity, any more than knowledge, in any other case, can constitute truth, which it presupposes."

But it seems reasonable to say that self-consciousness is a fairly good candidate to define what it means to persist as a person. Self-consciousness, or perhaps the soul, is something that is "ultimate, [and] unanalysable in terms of such observable and experienceable phenomena as bodily continuity and continuity of memory." A theory of souls upholds the dichotomy view; however, it is doubtful whether one is qualified to posit an opinion on souls. The Kantian argument is that people are not entitled to infer from the mind's functions, or its cognitive tasks and abstract subtasks, a constituent substance. For example, learning a software program does not confer an understanding of the hardware.

On the other hand, the run-of-the-mill psychological criteria do not fare so well. Even apart from Butler's analytic point, empirically, memories go daft. For example, I remember picking up a jacket on the steps to the United Nations building during a fourth grade field trip. In my mind, it is equiprobable that the jacket was mine and I had dropped it, of which I have an image; or that the jacket was a class-

46. See Chisholm, supra note 26, at 104-114.
50. Kant, supra note 19, at 445 (B 407).
mate's and I handed it to him. Consciousness is interrupted when we sleep, suffer amnesia, go insane, or are anaesthetized. In another example, given the unfortunate news that I will be tortured tomorrow, I would not be comforted by the additional information that, tonight, machine x will drain me of all current memories, while machine y installs into my brain someone else's past impressions.52

Perhaps these examples show why “[t]he most natural theory of personal identity which readily occurs to people, is that personal identity is constituted by bodily identity.”53 The problem is that a bodily identity theory immediately defeats dichotomism. Our bodies dissipate and replenish each day, and we have transplants and all sorts of -ectomies.

It seems that in the end, the dichotomist is left with a psychological basis for personal persistence. This essay does not quarrel with the view that conscious beings may persist by virtue of their consciousness. But neither does it accept that consciousness qua consciousness that does the trick. Otherwise, the amnesiac does not persist, nor does the anaesthetized patient or the sleeper. However, people want to say that they do persist. Moreover, it is useful to keep in mind the growing view that in the final analysis, psychological properties may be reducible, to some great extent, to physical ones.54

The above analysis suggests that the dichotomy view may collapse by reductio ad absurdum. We are loath to give up the view that persons persist, but at the same time our efforts at distinguishing persons from non-persons vis-à-vis persistence are not satisfactory. Chisholm is fairly confident and well rooted in persuasive authorities in believing that physical things do not persist, but he is unclear when it comes to persons. He concedes, “There may be no sufficient reason at all for deciding that you are or that you are not one or the other of the two different persons,” but reminds readers that the truth-conditions of a proposition that persons are continuants and the evidence we can have for assessing that proposition’s truth value are two different things.55

This article’s goal is not to firm up the reductio, but merely to show that it is reasonable to suspect that it fatally infects dichotomism. One

55. Chisholm, supra note 26, at 335.
can speculate from his writings that were Chisholm to be convinced by reasoning along these lines, he would resolve to delete persistence on the persons side of the divide because, after all, the evidence is just not there. However, this resolution seems to conflict with our best instincts. More likely than not, the author of Of Human Bondage was the author of Cakes and Ale.\textsuperscript{56}

This article begins with the presumption, which Chisholm rightly indicates has not been rebutted, that persons do persist. But, as we have seen, the feature underlying this continuance may not be unique to persons; and as noted earlier, if the persistence criterion that applies in the case of persons as continuants also holds in other cases, the dichotomy view fails.

Therefore, the focus shifts from analyzing whether persons persist or by which criterion they persist, to asking in which way non-person objects may also persist. If there is an acceptable answer for physical objects that also applies to persons, dichotomism is defeated and persons and non-persons alike may be deemed continuants, either in a philosophically satisfying, hence \textit{strict} sense, or in a \textit{loose} sense.

It is arguable that the time-slice view can generate an acceptable answer. If there are no reservations about stating that the Empire State Building is what it is at its base or at its mast and it is a spatially continuous entity, then it should not be too difficult to accept that the Empire State Building persists along a temporal axis from $t_0 \rightarrow t_1 \ldots t_n$. In time-slice thinking, each $t$-value becomes a temporal part or phase, conceptually analogous in many respects to the spatial partitioning that people endorse.

The spatial-temporal analogy is not pristine. We can come fairly close to an identity between temporal parts, but can not at all come close to an identity between non-overlapping spatial parts. For example, it is possible, logically and perhaps empirically, that the Empire State Building may endure unchanged between $t_{17}$ and $t_{18}$, but it is certainly not possible that its Fifth Avenue entrance is identical to the one on Thirty-Fourth Street. What exactly fills one region of space at a given time cannot be what exactly fills some other spatial region at the same time, but “the corresponding spacetime principle is wrong.”\textsuperscript{57} It seems that this point is not defeated by saying, as Armstrong does, that separate temporal phases “\textit{may be} different from


\textsuperscript{57} Peter van Inwagen, \textit{Four-Dimensional Objects}, 24 \textit{Noûs} 245, 248 (1990).
The premise shows that the disanalogy is that they may not be.

Nevertheless, identity is a stronger claim than persistence. Therefore, the idea that a thing's distinct temporal phases, but not spatial parts, may be identical does not cut against a time-slice view of persistence.

The time-slice approach would be challenged if persistence meant identity, but it does not. Persistence is a matter of unity, not identity. As Perry says, "It is extremely important not to confuse the unity relation for an object with the relation of identity." A relational view, as opposed to an identity view, provides the concept that warrants the persistence claim. For example, as the relation between one of the injector pump's gaskets and the rest of the pump unifies the two particulars, the relation between the pump at tₓ and at tᵧ is similarly one of unity.

Willard Van Orman Quine provides the groundbreaking thesis, and Mark Heller provides the most compelling argument for a time-slice approach. In the very first lines of his classic essay, Quine commits to "[t]he most natural theory." In other words, he asks how persons can be continuants given that our material substance is completely replaced every few years. Talk of immortal souls would be "agreeable," but would not solve Heracleitus's parallel problem, such as how we can say that we have bathed in the same river twice.

The truth for Quine is that "you can bathe in the same river twice, but not in the same river-stages . . . . A river is a process through time, and the river-stages are its momentary parts." Two river-stages at the same spatial coordinates are not identical, but merely "river-kindred"; likewise, a multiplicity of water molecules upstream on one day are water-kindred with the same molecular multiplicity downstream.

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59. John Perry, *Can the Self Divide?*, 69 J. Phil. 463, 468 (1972). Perry explains:

Of course the two are connected in an important way. If a and b are (temporal or spatial) parts of an object of certain kind K, and Rₓ is the (temporal or spatial) unity relation for Ks, then, if the K of which a is a part is identical with the K of which b is a part, a must have Rₓ to b. But, nevertheless, Rₓ is not the relation of identity, and must not be confused with it.

*Id.* Armstrong, on the other hand, "believe[s] that identity is not a genuine relation." Armstrong, *supra* note 58, at 67.

60. *Id.* at 68.
62. Swinburne, *supra* note 49, at 377; *see supra* note 49 and accompanying text.
63. Quine, *supra* note 61, at 621.
64. *Id.*
65. *Id.*
and maybe part of a different river on the next day. But if we were to point to river-stage \(a\) and later to river-stage \(b\), each time saying, "This is the Cayster," we would be inductively affirming the "identity" of the objects pointed to. In sum, imputing identity fixes the reference of the ostension.

Quine's 'identity' is not strict. Heracleitus summoned the river because it is always paradigmatically changing. Gottlob Frege, however, said a term's reference to "a single object" is the standard by which we may call the term "a proper name." As Quine restates Frege to decide whether a term is being used to name something, one may ask whether it is viewed as subject in any given context to "the algorithm of identity: the law of putting equals for equals." Sensitivity to contexts is a pragmatic feature. Under Quine's pragmatism, it is spurious to ask how much of science depends on language, and how much genuinely reflects reality; answering these questions requires a discussion about the world, and a presupposition of a "conceptual scheme peculiar to our own special language."

Nonetheless, calling the Cayster at \(a\) identical to the Cayster at \(b\) may invite the charge of an illicit slide from the momentary manifestation of a thing, called \(R\), to the manifestation of a momentary thing, say \(R\)-stage. One may be able to avoid the charge this way: (1) use 'identity' strictly; and (2) distinguish, as this essay has done, but Chisholm has not, between identity and persistence or continuance. Given (1) and (2), a thing's continuance from \(t_x\) to \(t_y\), in a strict and philosophical sense is not necessarily its strict identity at \(t_x\) and \(t_y\); nor does an admission of the lack of its strict identity at \(t_x\) and \(t_y\) contradict the claim of its strict continuance. Under these conditions, one can begin with the momentary manifestation of a momentary, albeit persisting, unified thing. Then, ending with the manifestation of a mo-

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66. Id. at 622.
67. Id.
69. Quine, *supra* note 61, at 630.
70. Id. at 632.
72. For Chisholm, "playing loose with the 'is' of identity" is tantamount to the "kind of looseness involved when we say that such things as the Ship of Theseus persist through time." Chisholm, *supra* note 26, at 275.
73. One way of illustrating these distinctions would be to say the Ship of Theseus before and after replacement of any one plank may be "identical" in a loose sense, but not in a strict sense. But the Ship of Theseus the Athenians end up with, while therefore not strictly identical, may be strictly persistent (depending on how we define the stuff of strict persistence; see Part IV, *infra*), whereas the Cretans' reassembled ship may be persistent only in some loose sense of the term.
mentary thing, such as R-phase, the momentary but not identical phase of a continuant thing, should not be seen as much of a slide.

In sum, this article suggests that one can bathe in a persisting river twice, at different points along the river’s spacetime line, which may be the same or different spatial coordinates. Two river-phases are “river-kindred”; but pointing to river-stage \( a \) and later to river-stage \( b \), while stating, “This is the Cañster,” is our way of affirming inductively the persistence, rather than the strict identity of the objects pointed to. Ostension locates the spatial parts of a spatial continuant, as well as the temporal phases of a thing in history, even if it is merely the history of its own continuance.

Recall the earlier scenario involving the injector pump. Witnesses in the case of A’s estate versus D are limited. They will point to the injector pump D sold and to the one A repaired, and state that they are the same. They will use the term ‘same’ in a Quinean contextual way. This article interprets their testimony, not as meaning that the pump-phases at sale and exposure are identical, but rather as meaning those phases unified two particulars, the pump at \( t_x \) and at \( t_y \).

Mark Heller’s argument for a time-slice approach is methodical. His goal is “to develop a clear account of the nature of temporal parts.” Heller’s most salient point shows how four-dimensional thinking solves a sticky philosophical problem. His thesis assumes that people want to say that each of the following propositions are true:

(a) My body is a physical object;
(b) There is a physical object in the space that is occupied by all of me except for my left hand;
(c) Physical objects can lose parts;
(d) There cannot be distinct physical objects occupying exactly the same space at the same time; and
(e) Identity is transitive (if \( a = b \), and \( b = c \), then \( a = c \)).

But affirming (a) through (e) leads to a contradiction if one assumes a three-dimensional view such as Chisholm’s. Given (a), there is such a thing as my body, which is called \( B \). Given (b), there is a physical object that is all of me except for my left hand, called \( B\text{-minus} \). If my

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74. Quine, supra note 61 at 622.
76. Id. at 312.
77. Id. at 313.
left hand is amputated at some time \( t_a \), this does not affect \( B\text{-minus} \); in other words, \( B\text{-minus} \) before \( t_a = B\text{-minus} \) after \( t_a \).

Given (c), losing a part does not end my body's existence. This must mean that \( B \) before \( t_a = B \) after \( t_a \). Under (d), however, \( B\text{-minus} \) after \( t_a = B \) after \( t_a \). In other words, if there cannot be distinct physical objects occupying exactly the same space at the same time, then those objects, such as \( B \) and \( B\text{-minus} \) at some time after \( t_a \), must be identical.

But under (e)'s transitivity rule, \( B\text{-minus} \) before \( t_a = B \) before \( t_a \). We know, however, that \( B \) was bigger than \( B\text{-minus} \) before \( t_a \); so \( B\text{-minus} \) before \( t_a \neq B \) before \( t_a \). This causes a contradiction.78

Heller explains that three-dimensionalists avoid the contradiction by denying one of the propositions (a) through (e). Chisholm, for example, denies (c). But that is an "unpleasant" way out.79 Four-dimensionality, under which (d) does not entail that \( B\text{-minus} \) after \( t_a = B \) after \( t_a \), is better according to Heller. Under this view, one may consider a temporal cross section of \( B \) after \( t_a \). In other words, consider \( B \) at some time after \( t_a \), or at \( t_a + \Delta t \). So think in terms of \( B \) at \( t_a + \Delta t \) lacking \( P \), where \( P \) is the property.80

In this case, we easily see that \( B \) at \( t_a + \Delta t \) is not \( B \) itself, wholly present and occupying the same space at the same time as \( B\text{-minus} \). For the larger spacetime region, \( R \), that begins at \( t_a \), \( B \) and \( B\text{-minus} \) overlap, but neither one exactly fills \( R \).81

For those who continue to object that two distinct objects seem to be in the same space at the same time, the author suggests that they seem to be. Heller's alternative response is that "[t]hese temporal parts are not two distinct objects, but rather, one object under two descriptions."82 At any \( t_a + \Delta t \), \( B \) and \( B\text{-minus} \) share a common temporal part, just as a home and garage may share a common spatial part if attached to one another.

IV. THE CAUSAL GLUE

A. A Propagation Approach

There is now a philosophical basis for concluding that D's asbestos-containing injector pump, like the Cayster or like you or me, persists. A thing at any particular time is not the whole thing (\( \Omega \)), it is just one of \( \Omega \)'s temporal parts or a slice in time. The thing persists temporally

78. Id.
79. Id. at 320.
80. In the equation just given, the property of having a left hand.
81. Heller, supra note 75, at 321.
82. Id.
in a way that analogizes to its unity across space. When we ask what persistence consists in, we are in a position to summon language common to law and metaphysics.

To say what \( \Omega \)'s persistence consists in is to explain how it is that \( \Omega \) yesterday and \( \Omega \) today are the same, \( \Omega \) being any whole object. This article is trying to explain how \( \Omega \) yesterday and \( \Omega \) today are temporal parts, not identical, but of the same thing. Heller says that a three-dimensionalist similarly has to explain how \( x \) one day may be \( x \) the next, and that a four-dimensionalist’s explanation need not be too different.\(^8^3\)

It seems reasonable, at least as a starting point, to say that a thing’s persistence may consist in one of at least three factors: (1) some unanalyzable property; (2) convention; or (3) some sort of causal flow. As Charles Dunbar Broad says in another context, Factor 1 can hardly be counted as a way of explaining persistence because it states persistence cannot be explained “but must simply be swallowed whole with that philosophic jam which Professor Alexander calls ‘natural piety.’”\(^8^4\) Calling persistence primitive entails an assumption that is both unnecessary and unfounded. Viewed another way, a conclusion that persistence is unanalyzable may presuppose the sort of rigor involved in showing that a proposition is undecidable, which is a task even Kurt Gödel did not undertake for any particular propositions.\(^8^5\)

In any event, even if persistence was primitive, our treating it otherwise would be permissible, “though at the expense of multiplying moves.”\(^8^6\) Therefore, factor 1 must be rejected.

Factor 2 provides an explanation dealing with our intersubjective arrangements, not prior facts of the matter. In other words, factor 2 says that there is something about \( \Omega \) that entails its persistence, but only by virtue of the conventions that people have adopted. This is a compelling position. Whether one takes the Eiffel Tower and Wilfred Owen’s\(^8^7\) rifle-butt to be a single object is set in a matrix of human interests and judgments that define our “presumably common fund of

\(^8^3\) Id. at 322.


\(^8^7\) English poet noted for his anger at the cruelty and waste of war. See www.britannica.com/eb/article?eu=59242&tocid=0&query=Wilfred%20Owen (last visited Aug. 1, 2001). He is noted for his experiments in assonance.
conceptualization.” But when our reference frame settles due to that common fund, we are left with some $\Omega$ within the set of all things.

Hillary Putnam stated that what is conventional and what is factual is relative to the alternatives that are sensible in the context. Saying there is an injector pump on the USS Casablanca, instead of saying there is a field of colliding particles, may be a matter of convention, while saying the pump or field persists should be a matter of fact within our fixed reference frame. Therefore, we are willing to overlook those in the familiar three-dimensional world who are prepared to waive the idea that the toaster ends where the rugrat begins. It does, but not simply by mutual understanding, rather in stable theory.

It is tempting to conclude that persistence is a matter of social construction, and that people can construct that notion differently. Perhaps they can. For example, Heller sees one’s computer as persisting, while Chisholm applying Hume, says people “feign identity when what [they] are dealing with is in fact only a ‘succession of related objects’.” While people can have differing conceptual schemes, as Quine states, it does not follow, as Chisholm would say, that things will not in fact be one way or the other.

Conceding that the idea of persistence is precisely the area in which evolutionary epistemology may be at its weakest, there may be much to be said for the position that biological mechanisms select our general beliefs. Perhaps one can merely hypothesize which beliefs evolution has scythed, but even tiny infants “expect objects to continue to exist after the objects go out of sight,” and that is not an

90. CHISHOLM, supra note 26, at 280; DAVID HUME, A TREATISE OF HUMAN NATURE 254-55 (L.A. Selby-Bigge ed., 2d ed. 1888) (1739-40) (saying “[t]hus we feign the continu’d existence of the perceptions of our senses . . . [and] attribute identity, in an improper sense, to variable or interrupted objects”).
91. Quine, supra note 61, at 632.
92. CHISHOLM, supra note 26, at 335.
94. Cf. Harold N. Lee, Discourse and Event: The Logician and Reality, in 18 THE LIBRARY OF LIVING PHILOSOPHERS: THE PHILOSOPHY OF W.V. QUINE 295, 310 (Lewis Edwin Hahn & Paul Arthur Schilpp eds., 2d ed. 1987) (saying minds “are functions of the organism. The organism is what has developed and survived in the course of evolution, but evolution is a continuous process, and in this process intelligence has emerged as a major survival mechanism of humans.”).
95. Paul Bloom, Language and Mental Life, in TOWARD A SCIENCE OF CONSCIOUSNESS II: THE SECOND TUCSON DISCUSSIONS AND DEBATES 561, 568 (Stuart R. Hameroff et al. eds., 1998) (citing R. Baillargeon, Object permanence in 3.5- and 4.5-month-old infants, in 23 CHILD DEVEL-
expectation that experience frustrates with age. So it seems that evolution has selected our belief that things persist. While this does not guarantee the belief is right or that it is not some sort of evolution-based, nondiscretionary convention, it is at least strong evidence that members of the species that do not share the belief find themselves at serious odds with reality.

This suggests that although we cannot rule out the idea that persistence is simply a matter of convention, there are probably good reasons for concluding that the continuation of things has something to do with the way they really are. In other words, if one understands persistence, one is likely to know something about the thing said to persist, not just about social psychology or stipulation.

But if persistence is an analyzable feature of physical things as they really are, we are back to our original question: what does this persistence consist in? For Bertrand Russell, persistence was a causal line: “A causal line may always be regarded as the persistence of something—a person, a table, a photon, or what not. Throughout a given causal line, there may be constancy of quality, constancy of structure, or a gradual change of either, but not sudden changes of any considerable magnitude.”

One can say two things about the idea that persistence consists of some sort of causality. First, if that were the case, then causality would nicely explain the welding of a thing’s temporal parts. And second, perspicacious thinkers think it may be the case.

However, an appeal to authority, such as Locke’s *argumentum ad verecundiam*, is not good enough; an argument is needed. If it is logically necessary that a thing’s temporal parts be causally connected, then persistence depends on causation. And if persistence depends on causation, then persistence is explained in a very compelling way.

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96. See supra note 31 and accompanying text.


98. See e.g., ARMSTRONG, supra note 58, at 74-78; HELLER, supra note 75, at 323; RUSSELL, supra note 96.

99. See Jaegwon Kim, Explanatory Knowledge and Metaphysical Dependence, 5 PHIL. ISSUES 51, 68 (1994) (proposing that “explanations track dependence relations”).
David Armstrong provides a decent example. Assume there are two very puissant deities, each with the split-second clout to destroy and create, who operate independently of each other. The first deity annihilates Jack Kerouac at a place \( p \), and at time \( t \). The second deity, unaware of what the first is up to, and who has never heard of any beat poet, decides to create a man at \( p \) and \( t \). By coincidence on a cosmic scale, the second deity’s man has exactly the same physical and mental characteristics that Kerouac had at \( p \) and \( t \).

The question is whether Kerouac has persisted. Although all humans on the scene, including Kerouac\(_2\), will say ‘yes’, our intuition will be strongly in the other direction because we know what happened. The reason is a break in the causal nexus between Kerouac\(_1\) and Kerouac\(_2\). In other words, Kerouac\(_2\) derives from the creative deity, not from Kerouac\(_1\). Armstrong opines, incidentally, that if there were some “suitable” causal connection between Kerouac\(_1\) and Kerouac\(_2\), even a spatiotemporal gap between the two would not defeat Kerouac’s continuance.

Armstrong argues nicely in favor of the causal theory. At the same time, though, it is probably possible to concoct a counterexample, showing that even a causal link between Kerouac\(_1\) and Kerouac\(_2\) is not sufficient to confer persistence. For instance, assume the second deity encounters Kerouac\(_1\) at \( p \) and \( t \), and decides instantaneously to create a duplicate. The first deity still annihilates Kerouac\(_1\), and we are again left with only Kerouac\(_2\), but this time there is a causal connection between the two Kerouacs. It seems that intuitively, one would not favor the notion that Kerouac has persisted.

Although Armstrong might respond that such a causal connection would not be “suitable,” what we may infer from the counterexample is that causality, however necessary, is not a sufficient condition for persistence. Indeed, Armstrong’s suitability requirement implies the same idea. One would therefore resolve the sufficiency issue by figuring out what sort of causal connection between temporal parts is suitable. It should be noted however, that Armstrong concedes that he has not done so.

Hume’s classic pronouncement was that “we may define a cause to be an object, followed by another, and where all the objects similar to the first are followed by objects similar to the second. Or in other words where, if the first object had not been, the second never had

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100. See Armstrong, supra note 58, at 76. The context in which Armstrong offers his similar example is the debate between the identity and relational views of persistence.
101. Id.
102. Id.
Hume’s first sentence says causation is a matter of constant conjunction; however, his “other words” offer a counterfactual notion of causation. It is difficult to conceptualize oneself today and tomorrow, or the radiator yesterday and today, in terms of constant conjunction. It is unclear whether things like people at \( t_1 \) are always followed by things like people at \( t_2 \). What does seem clear is that persistence applies not only to aggregate entities, such as the United States Supreme Court, but to individuals, such as Cardozo. Hume’s first sentence suggests that causes and effects can be named by singular terms; on the other hand, the idea of causal regularities means looking beyond single instances to “events of similar sorts, similarly conjoined.”

The counterfactual analysis offers little help. In the counterexample to Armstrong’s position, but for Kerouac, Kerouac “never had existed.” Hume did not have to work these issues through because for him, we only “feign” identity.

Russell, on the other hand, did have persistence in mind. His persistence was a causal line. A flow or propagation theory of causation, seeing causality as a property of individual processes, seems most compatible with the notion of a causal line and may give us the key to persistence. Professor Wesley Salmon’s analysis takes us most of the way there.

Recalling Russell, Salmon proffers “two fundamental” and “intimately related” causal concepts: production and propagation. For Salmon, each concept is very familiar to common sense. For example, production comes to mind when we say a hammer’s blow drives a nail, meaning that “the impact produces penetration of the nail into the wood . . . When we say that a person’s embarrassment was due to a thoughtless remark, we mean that an inappropriate comment pro-

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104. See David Lewis, Causation, 70 J. Phil. 556, 556-67 (1973).
105. Donald Davidson, Causal Relations, 64 J. Phil. 691, 691 (1967).
108. Id. at 254.
111. Salmon, supra note 39, at 285.
duced psychological discomfort.” Examples of propagation are equally familiar. “By means of memory, the influence of . . . past events is transmitted to the present. . . Signals transmitted from a broadcasting station are received by the radio in our home.”

Under Salmon's analysis, causal influence is propagated by causal processes, and causal interactions produce changes in those processes. These two new terms require definition: causal processes and causal interactions. At the risk of circularity, causal processes, paradigmatically an electromagnetic wave or a moving particle, are the means by which structure is propagated or transmitted from one spacetime region of the universe to another. Causal interactions are typified by various sorts of collisions that modify structures. So propagation usually takes a while, whereas production is often simultaneous.

Before returning to persistence and its legal implications, two more ideas must be explained. The first is the difference between causal processes, which are capable of transmitting information or signals, and pseudo-processes, which are not. An intervention into a causal process permanently transforms that process. For example, if a red filter is hung along the path of a light beam, the beam will appear red the rest of the way. Illustration of pseudo-processes include shadows and spots of light cast on a wall from some distant light source. If an airplane's moving shadow is modified when crossing a thatched roof to form a new shape, that modification will not persist.

The second idea is illustrated with a fork metaphor. A conjunctive fork has to do with the common cause of two or more effects. For example, A and B eat bad salmon at Sushisay. Their resulting illnesses are not independent, so the probability of A and B getting sick is greater than the product of the probabilities of their individual illnesses: \( P(A \cdot B) > P(A) \times P(B) \). But, given their common cause, A's and B's illnesses occur independently. So: \( P(A \cdot B/C) = P(A/C) \times P(B/C) \). Another way of looking at this is to say that the salmon, com-

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112. Id. at 285-86.
113. Id. at 286.
114. Id. at 295.
115. Id. at 296.
116. Id. at 298.
117. Id. at 300.
118. Salmon, supra note 39, at 287.
119. Id. at 289. See generally Hans Reichenbach, Philosophie der Raum-Zeit-Lehre (1928); Hans Reichenbach, The Direction of Time (1956).
mon to A and B, screens off or makes statistically irrelevant one's illness from the other's.\footnote{Salmon, supra note 39, at 290-91.} Salmon provides other probability conditions not necessary here, and explains the stipulation that none of the relevant probabilities equal zero or one. \textit{Id.}

An \textit{interactive} fork, on the other hand, involves a direct interaction between two processes. If Chubbs, a pool player, sinks the 8-ball, he sinks the cue ball, too. Chubbs has a .5 probability of sinking the 8-ball and a .5 probability of scratching. This scenario is not a conjunctive fork, though, because the balls' collision does not screen off the outcomes. In other words, the prior .5 probability that Chubbs scratches, is not equal to the 1.0 probability that he scratches given that he sinks the 8-ball. So with interactive forks involving the spatio-temporal intersection of causal processes, the modifications in each process, A and B, respectively, persist after the intersection (C).\footnote{\textit{Id.} at 294-95.}

For such a causal interaction: $P(A \cdot B/C) > P(A/C) \times P(B/C)$.

\textbf{B. Legal Terms}

This article began with a harmful product causing injury, and addressed the issue of whether the original manufacturer is legally responsible. Cardozo says the product persists as "a thing of danger" even when its buyer changes component parts, unless the conduct of the new part's manufacturer is an intervening cause.\footnote{MacPherson \textit{v.} Buick Motor Co., 217 N.Y. 382, 389-90, (N.Y. 1916).} This persistence can be explained in terms of a causal flow. A thing persists by transmitting its own structure through time in a causal process.

How is it that a subway map or an axe-head propagates its own structure when it seems just to rest there uneventfully? Ordinary perception misses the electromagnetic forces that hold a thing's molecules together. Atoms are not divisible but loaded with subatomic particles. The Rutherford-Bohr model of the atom\footnote{\textit{See} Albrecht Fölsing, \textit{Albert Einstein} 476-477 (Ewald Osers trans. 1997) (1993); \textit{Georg Joos}, \textit{Theoretical Physics} 647 (3d ed. 1958).} and its orbiting electrons did not hold up, but in the modern model, electrons move around the atomic nucleus in K, L, M, N, O, P and Q shells, consisting of probability clouds. For Richard Feynman, the most informative scientific sentence is the atomic hypothesis "that all things are made of atoms—little particles that move around in perpetual motion, attracting each other when they are a little distance apart, but repelling upon being squeezed into one another."\footnote{Richard P. Feynman \textit{et al.}, 1 \textit{The Feynman Lectures on Physics} 1-2 (1963).} This is all causal language for reckoning a debris of scrubbed shells at $t_1 \ldots t_n$.\footnote{\textit{Id.} at 294-95.}
Products liability law aligns with a variant of the causal line approach to persistence. Jaegwon Kim explains that causal processes consist in constituent events and properties. In law, intention or purposefulness is often requisite to liability. Legal causation is traditionally associated with the mental element of foreseeability. Intention is a suitable signifier of foreseeability. Intentions and purposeful designs are constituent properties of a persisting thing, a causal flow, in product liability cases.

However, one should be prepared to concede at this point, that while persistence arguably has to do with a fact independent of inter-
subjective agreement, legal constituent elements are conventions laid down in the legal culture. Law, after all, is a social construction. If a social arrangement is a constituent element in persistence, one may have to accommodate a relativized identity or persistence at least to some extent. It is not unreasonable to hold that one’s world view meshes “meager input” with “torrential output,” and sensory content with conceptual scheme. When talking within a legal framework, one is usually dealing with an admixture of the way things are and the way we fix them.

A more pressing concern is whether law must have any patience for persistence at all, given that its decision-making is based on intention and foreseeability. Imagine a hypothetical antagonist, William, who provides the following scenario: An exploding soda bottle topples a lamp that strikes Mrs. P. No one claims the bottle is one of the lamp’s spatial or temporal parts. Nevertheless, the bottle manufacturer may be liable if that sort of sequence of events was deemed reasonably foreseeable, assuming that other elements were accounted for. Thus, in the earlier pump scenario, if D’s pump ceases to exist due to replacement asbestos gaskets and a different thing begins, foreseeability alone should make the case for A’s estate and the notion of persistence is shaved away.

A response to William’s argument examines the notion of “reasonable foreseeability” upon which he relies. Legal scholars say that this concept melds objective and subjective factors. A shift in philosophy’s accepted view, entailing that D’s pump did not persist through the time of A’s exposure, would filter through the collective consciousness and skew the foreseeability factor. A court’s or fact finder’s judgment regarding what a party should reasonably have anticipated in the context of the component parts issue must depend, at least to some extent, on a supposition about whether A encountered D’s product. D rightly believes it will benefit if it can convince the court that the injurious product could not have been the same product it sold, as a philosophical, as well as legal matter. D’s lawyers will likely cite Chisholm’s argument, if they have encountered it, going beyond the theories of Wood and Exxon. Although ‘foreseeable’ is a

130. For example, the bottle was not tampered with post-sale.
132. See supra note 7 and accompanying text.
133. See supra notes 23-26 and accompanying text.
customary legal term, the component parts problem tightly weaves issues of persistence and foreseeability.

C. Tweaking Salmon’s Theory

Causation welds persistence and, in tort law, intention is one signifier of foreseeability, which is causally meaningful. Salmon’s propagation approach to causation suggests the next concern. He seems to prescribe an ontological distinction between causal and pseudo-processes. If one tries to locate intention within that ontology, it appears to fall on either side of the divide. The problem is that in the context of the persistence, as opposed to the manufacture of defective products, intention seems to be the constituent of pseudo-processes, not causal processes.

Consider the status of human beings as agents. Donald Davidson labels “anything an agent does intentionally an action, including intentional omissions.” It is easy to see that a person’s intentions have causal efficacy in that context. If that intention changes before one has acted, that modification will persist and one will perform a different action.

The way people’s intention may persist in a product of our actions is different. That sort of process is more akin to a pseudo-process, where intention lies in the product like a light spot that is projected onto the wall or a shadow cast on the pavement. The spot that is shaded will be colder and could allow for a dangerous ice patch. One could heat the spot and melt the ice, but the shadow itself continues in its regular way, perhaps manifesting but not transmitting, causal energy. The previous discussion of the Welch and Morris cases suggested that a defendant’s intention or purposefulness seemed to be

134. Donald Davidson, Actions, Reasons, and Causes, 60 J. Phil. 685, 686 n.2 (1963). Nor is it likely the causal question is begged once we acknowledge intention’s mind-dependence. Analogously, the received view has been that color is a subjective property, just an appearance we bring to things. See Barry Stroud, The Quest For Reality: Subjectivism and the Metaphysics of Color (2000). But for Salmon—who, let’s assume, would subscribe to that view—color can be a constituent in a causal process. Salmon, supra note 35, at 288; cf. Stroud, supra, at 176-77 (offering, at least arguendo, that, although many view color as “causally inert, . . . it is not true that colour plays no role in what goes [on] in the world if part of ‘what goes on’ is that people see lemons to be yellow, tomatoes to be red, and so on. Jones sees a lemon on the table and sees it to be yellow, in part because there is a yellow lemon there. If an object of that colour had not been there, she would not have seen the colour she saw”). The question of whether intention is a constituent in a pseudo-process—and we’re saying it is in connection with a product’s persistence—is an independent one, and it is only in that case that Salmon’s approach would deprive it of causal efficacy.


136. See supra notes 15-22 and accompanying text.
projected onto the injurious product in its later phases. Salmon might assert that, as one can warm a shaded cold spot, a manufacturer could repair the product and make it safe; however, the manufacturer’s design or intent remains unchanged, already projected onto that product’s “world-line.”  

Because we can conceive of intention’s role in both causal and pseudo-processes, it seems fair to say that what makes a process pseudo is not the pseudo-status of its constituent events or properties qua events or properties, but rather the way in which these events or properties are connected with one another. However, when intention is connected with a product in such a way that Salmon would call it “pseudo,” to be consistent with his approach, it cannot be causally meaningful. We need intention to be causally efficacious as a constituent element in a product’s persistence because this is the best explanation of how a defendant’s conduct may be linked to injury caused by dangerous replacement components.

In other words, if intention or purposeful design is a mere pseudo-constituent in the context of persistence, then it does not carry the causal power needed to transmit a defendant’s blameworthiness to the injurious event. This would fortify a manufacturer’s defense that replacement of the dangerous parts severed the causal link between its misconduct and the harm. Courts’ adopting this legal rule decree, on society’s behalf, a modified convention.

However, the replacement of a dangerous component part with a similarly dangerous part is itself evidence that the maker’s intent is causally influencing actions down the road. This fact pulls in the direction of reforming Salmon’s thesis. Indeed, a closer look shows that there is a significant gap in Salmon’s treatment of the causal status of pseudo-processes. His profound essay suggests, but does not directly address, the phenomenon of the intersection of a causal process with a pseudo-process. This lapse points to an interesting enigma in his propagation view of causality.

Salmon says the world “is full of processes (causal or pseudo-) and these processes undergo frequent intersections with one another.” Causal processes may intersect, of course, and Salmon allows that the

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137. Salmon, supra note 135 at 308.  
138. I thank Jaegwon Kim for suggesting this point.  
139. My critique is not derived from either Nancy Cartwright’s counterfactual criticism, see Salmon, supra note 137, at 302 (talking about Cartwright’s counterexample conveyed to Salmon “in conversation”), or from Dowe’s conserved quantity criticism. See Phil Dowe, Wesley Salmon’s Process Theory of Causality and the Conserved Quantity Theory, 59 Phil. Sci. 195, 195-216 (1992).  
140. Salmon, supra note 39, at 295.
same is true of pseudo-processes, such as when the shadows of two airplanes coincide momentarily.\textsuperscript{141} In the latter case, neither process is modified in any lasting way. Salmon also indicates that \textit{only} causal processes can be involved in a causal interaction: "If two processes intersect in a manner that does qualify as a causal interaction, then we may conclude that both processes are causal, for each has been marked or (i.e. modified) in the intersection with the other, and each process transmits the mark beyond the point of intersection."\textsuperscript{142} At the same time, causal processes can intersect without modification in either case, just as when light rays pass through one another.\textsuperscript{143}

Although Salmon may be focusing on the circumstances of an intersection between a causal process and a pseudo-process, called a \textit{hybrid} intersection, his language is ambiguous. In a passage that nearly recognizes the hybrid, Salmon says, "If either or both of the intersecting processes are pseudo-processes, no such mutual modification occurs."\textsuperscript{144} The issue left open by this statement is whether, in a hybrid intersection, a modification may occur in only one of the processes.

Salmon meant to say no. For him, when two processes intersect and energy and momentum "are transferred from one to the other, their respective states of motion are altered."\textsuperscript{145} This can happen "only when two causal processes intersect."\textsuperscript{146} However, Salmon does not expressly state that if either or both of the intersecting processes is a pseudo-process, there cannot be a modification in either. So it may be useful to examine the hybrid from both sides.

When a hybrid intersection occurs, the pseudo-process will often be modified, but not in a way, that persists beyond the period of intersection. If a beam of light is cast on a shadow, the shadow, paradigmatically a pseudo-process, would be modified by fading or disappearing, but only so long as the beam continued to be cast.

More interestingly, hybrid intersections often do seem to produce lasting modifications in the causal process, and therefore, take on the appearance of causal interactions, at least in ordinary language interpretations. For example, a racehorse galloping down the home stretch intersects with a shadow across the track and jumps it or swerves wide of it. Arguably, the shadow caused the horse to lose the race. A spotlight with a red lens attached and mounted at the center of an other-

\textsuperscript{141} Id. at 294.
\textsuperscript{142} Id. at 295.
\textsuperscript{143} Id. at 294.
\textsuperscript{144} Id.
\textsuperscript{145} Id.
\textsuperscript{146} Salmon, supra note 39, at 294.
wise darkened bullfighting arena, casts a large spot of red onto the wall of the ring, thus enraging the bull. Arguably, the spot caused the bull to charge. On a hot day people cool down in the shade; arguably, the shade cooled them off.

Salmon’s view is friendly toward ordinary language uses of causal concepts. At the beginning of his essay, he explains causal production in everyday terms. For instance, “[w]hen we say that a person’s embarrassment was due to a thoughtless remark, we mean that an inappropriate comment produced psychological discomfort.” But Salmon neglects to account for the causal characteristics of certain hybrid intersections that seem equally “familiar to common sense.”

Furthermore, in these instances of apparent modifications in causal processes involved in hybrid intersections, other approaches to causation would attribute causality to the pseudo-processes. Describing the counterfactual view, David Lewis says, “If c and e are two actual events such that e would not have occurred without c, then c is a cause of e.” But for the shadow across the track, the racehorse would have run straight; but for the shade, we would have remained hot; but for the red spot, the bull would not have charged. Causality could also be ascribed in these scenarios in terms of Humean regularities.

According to Salmon’s early propagation view, the difference between a causal process and a pseudo-process lies in the capability of

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147. Id. at 286 (emphasis added).
148. Id. at 285.
149. Lewis, supra note 106, at 563.
150. Hume, supra note 105 at 72.
151. Salmon later revised his approach, in light of Dowe’s criticisms, by adopting a conserved quantity transmission view in lieu of the mark transmission idea. Salmon, supra note 137, at 303. The dialogue between Salmon and Dowe may lead to a clarification of the issue I’m addressing in this article, but only per chance. Dowe’s generalization is that pseudo-processes do not “possess the type of physical quantities that are governed by conservation laws. Shadows, intersections of world lines and so on do not possess conserved quantities.” Dowe, supra note 141, at 212. Professor Salmon accepts Dowe’s definition of a causal interaction, being “an intersection of world lines which involves exchange of a conserved quantity.” Id. at 210; Salmon, supra note 137, at 304. But Salmon does not agree fully with Dowe’s understanding of pseudo-processes, and their respective views may be significant here, although neither expressly addresses the hybrid interaction. Salmon’s argument is that a pseudo-process, such as the spot on the wall, “manifests energy in an appropriately regular way, . . . but it is not the world-line of a causal process because the energy is not being transmitted; it is being received from an exterior source.” Id. at 308 (emphasis added). Dowe objects that it isn’t the spot that possesses conserved quantities, such as energy or momentum, but the patch of wall. Phil Dowe, Causality and Conserved Quantities: A Reply to Salmon, 62 Phil. Sci. 321-333, 327 (1995). They concur, though, that a pseudo-process, such as a shadow, is an “object.” Id. at 331 (saying “an object, such as a shadow”). My examples regarding the race horse and the bull concern perception. See supra notes 142-143, and accompanying text. Perhaps, in the sense that the object of perception is said to cause the perception; D. M. Armstrong, A Materialist Theory of the Mind 229 (Routledge & Kegan Paul eds. 1968) (saying “[i]f A is said to perceive an x, then it is entailed that x is
the causal process to transmit marks by transmitting its own structure. But causal influence, for Salmon, is propagated interactively. He says, for example: "A causal influence transmitted by sound waves can make your dog come running." Even though a shadow, unlike a pulse of light, cannot transmit its own structure or a mark, it can "make your dog come running" or a racehorse swerve wide.

Nevertheless, Salmon's probability formula, $P(A \cdot B/C) > P(A/C) \times P(B/C)$, describing the relation involved in the notion of an interactive fork in many cases does not hold for a hybrid intersection. Where $A$ stands for a modification in the causal process, and $B$ for a modification in the pseudo-process, it is not the case that $P(A \cdot B/C) > P(A/C) \times P(B/C)$ because $P(A \cdot B/C) = P(B/C) = 0$. We are asking whether it may ever be possible that $P(A/C) > 0$.

So Salmon does not explicitly address the possibility of a hybrid intersection as this article has defined it, upon which only one of the processes is modified. It is also worth noting that Salmon does not discuss the possibility of any intersection upon which only one process is modified. Where each process is causal, it seems uncontroversial that one and only one may be modified. For example, a friend's smile may cause another to smile, yet continue unchanged. Or consider the collision of one billiard ball $A$ with another $B$, where $B$ is fastened immovably to the table and thus, where $P(B/C) = 0$.

Salmon's language does not necessarily foreclose the possibility that, in a hybrid intersection, the causal process may be modified; he only says there cannot be a mutual modification in such a case. How-

152. Salmon, supra note 39, at 289.
153. Salmon is careful to point out that "[t]his relation is not, however, any part of the definition of interactive fork or causal interaction." Id. at 301 n.11.
ever, his argument is most reasonably understood to imply that in a hybrid scenario, there cannot be a lasting modification in the causal process. He does not explicitly say this, however, and other approaches to causation may suggest otherwise. It should now be easier to see how, if one modifies Salmon's view on this point, one might resolve the problem of the causal role that intention plays in the persistence of things, at least in the products liability setting.

The outcome of all of this is that even when intention falls within Salmon's ontology as a pseudo-constituent, the process intention comprises may nevertheless be genuinely capable of causally transmitting a legal actor's tortious misconduct. Despite Salmon's analysis of pseudo-processes, the wrongful intention going into a product's manufacture could have the causal efficacy that Cardozo seemed to be reading into the idea of the persistence of things.

V. Conclusion

Like proximate cause and duty of care, law and philosophy intertwine in ways that invite analysis. Courts say 'persist' from time to time, and its use is manifest or penumbral when component parts issues arise in tort law. The time-slice view explains a harmful product's persistence, and the metaphysical basis for linking a manufacturer's misconduct to temporally distant injury. Law complements the idea that causality welds persistence, and stabilizes a critique of the propagation approach to causality that persistence may entail.