

The Problem of Surplus¹

Abstract: We can tolerate certain kinds of abundance but not others. I argue that some metaphysical theories are in danger of being intolerably abundant. They posit “too much” of certain quantities at a given location. The problem of positing too large a quantity, which I call the problem of surplus, arises in fragmented ways across different philosophical discussions, from material constitution to the metaphysics of action. I argue that there is no existing general solution to the problem of surplus, and I appeal to the notion of logical parthood to provide a unified solution to the problem. I then formulate novel constraints concerning logical parthood that are useful to a wide variety of metaphysicians.

Word Count: 10,095

Certain metaphysical theories threaten to posit “too much” of a quantity at a given location. The problem of positing too large a quantity, which I call the problem of surplus, has been raised and addressed in fragmented ways across different debates.

To illustrate one version of the problem, suppose we distinguish a person from a colocated human animal, and suppose the person experiences a certain amount of happiness. Does the human animal experience the same amount of happiness? If so, should we sum the happiness of the person and the animal? To sum their happiness would be to overcount the happiness in that location. These questions and concerns replicate with other quantities—from physical properties, like mass, to normative properties, like value. Without a way to prevent overcounting, many metaphysical theories conflict with our physical, psychological, and normative commitments.

¹ For helpful criticisms and suggestions, thanks to Tania Aiyar, Yuval Avnir, Mark Balaguer, Shamik Dasgupta, Heather Demarest, Zoe Drayson, Sam Elgin, Ann Garry, Verónica Gómez Sánchez, Ronald Houts, Li Kang, Jacob Lettice, Jed Lewinsohn, Jon Litland, Hugo Luzio, Ned Markosian, Michaela McSweeney, Henry Mendell, Adam Pautz, Ezra Rubenstein, Jonathan Schaffer, Adam Sennet, Betty Shumener, Eleanor Taylor, Hannah Tierney, Jenn Wang, Howard Wettstein, and Isaac Wilhelm. I’d also like to thank audiences at Cal State LA, Claremont College, UC Davis, UC San Diego, Princeton University, Johns Hopkins University, and the University of Lisbon. I’d like to especially thank Martín Abreu Zavaleta, Grace Atkins, Nathaniel Baron-Schmitt, David Builes, and Maegan Fairchild for their especially extensive, necessary, and patient feedback. All mistakes contained in the paper are solely my own.

I argue that there is no existing general solution to the problem, and I suggest that we can solve the problem of surplus once we pay attention to *logical parthood* relationships.² One entity is a logical part of another when the latter logically implies the existence of the former. Logical parthood bears similarities to mereological parthood. Just as we ought not sum the mass of a table and one of its mereological parts, such as its leg, we ought not sum the mass, happiness, value, and so on, of an entity with that of one of its logical parts.

I develop constraints concerning logical parthood to provide a unified solution to the problem of surplus. Providing a unified solution is significant because it shows that we can solve a quantitative puzzle that arises for physical, mental, and normative properties at once. The problem of surplus is especially salient for pluralists—those who posit distinct, colocated entities, but I proceed to argue that pluralists and monists alike should accept constraints concerning logical parthood, and I demonstrate how to extend such constraints along multiple dimensions. Thus, I suggest that logical parthood constraints are of wide and under-recognized value to metaphysicians.

I. The Problem of Surplus under Three Guises

There is reason to posit distinct, colocated entities in a variety of debates. Persons are colocated with human animals, but human animals and people may differ in their essential properties. People, perhaps, can survive the death of their human animal bodies while the human animals cannot. Some metaphysicians of action distinguish colocated acts, such as the *flipping of the light switch* and *alerting the burglar* because the flipping of the light switch could have occurred without alerting the burglar, but you cannot alert a burglar without alerting a burglar.³ Substance dualists distinguish brains and souls due to their property differences.⁴ Others distinguish statues and the lumps of clay that constitute them.⁵ We may also

² There are multiple characterizations of logical parthood. I initially follow David Lewis's (1986) conception of logical parthood in "Events," which differs from L.A. Paul's (2002). Paul is concerned with the relationships between properties in a bundle-theoretic metaphysics. I am not committed to realism about properties or to whether properties fall under the range of a first-order quantifier.

³ These actions are distinguished on a fine-grained theory of events, such as Jaegwon Kim's (1976), which distinguishes events based on their different property exemplifications. Donald Davidson (1963, 686) discusses this specific example although Davidson takes "flipping the light switch" and "alerting the burglar" to be two descriptions of the same action.

⁴ For discussion of substance dualism see (among many others) Amo (1774/2020), Plato (2002), Descartes (1641/1984), Cutter (forthcoming), Kripke (1972), Plantinga (2007), Swinburne (2014, 2019), Zimmerman (2010a, 2010b). However, not all substance dualists think that minds or souls are colocated with brains or bodies—especially if souls lack extension.

⁵ See for discussion (as a small sample): Baker (1997), Carmichael (2020), Dorr & Hawthorne with Yli-Vakkuri (2021), Fairchild (2019, 2020, 2023), Fine (1982, 2003, 2022), Johnston (1992), Koslicki (2008, 2018), Paul (2002), Rea (1998), Sider (2001) Thomson (1983), Wiggins (1968), Yablo (1987).

distinguish establishments, like restaurants and organizations, from the real estate where they are located,⁶ and so on. The view distinguishing colocated entities is called “Pluralism:”

Pluralism: There are distinct spatiotemporally coincident entities.

Entities (specifically, objects and events, including acts) spatiotemporally coincide if they are numerically distinct, and, at least during part of their existence, they exist at the same place at the same time.⁷ In the case of objects, pluralists often take distinct coincidents to *materially coincide* in the sense of sharing all their material parts during at least a portion of their existence.

Pluralism is especially susceptible to the problem of surplus. I first illustrate the problem of surplus with three examples.

- (1) **University Statue:** Suppose that in addition to a statue there is a colocated, distinct lump of clay on the university quad. Both the statue and the clay are 40kg. If we treat the mass of the statue and clay as we typically treat the mass of distinct objects, we will posit at least 80kg of mass on the quad; however, we do not want to claim that there is 80kg of mass on the quad.⁸
- (2) **Ice Cream Cone:** There is a person (“Bertha”) colocated with a distinct human animal. Say that an ice cream cone delivers 30 hedons of pleasure to its eater. Bertha and the Bertha-animal both eat the ice cream cone. So, it seems there should be 60 hedons of pleasure where Bertha is located, but that would be to countenance too much pleasure.⁹
- (3) **Fratricide:** In a fit of rage, Romulus quickly stabs Remus. We believe that the stabbing and the quick stabbing are distinct, colocated acts (which are a subset of events). Suppose all stabbings are worth –50 units of value. It seems that Romulus’s acts should have earned at least –100 units of value in that case (–50 units from the stabbing and –50 units from the quick stabbing); yet, there is too much disvalue if we count that way.¹⁰

The properties in the above examples all count as “quantitative” because they have a determinate-determinable structure, and they come in different comparative amounts that we can represent with numerical values.¹¹ These examples concern radically different quantities; nevertheless, they all involve overcounting quantities in the same problematic way. The pluralist must deny that the quantities possessed by the distinct objects or events add up

⁶ See for discussion, Korman (2020), Horden & López de sa (2024).

⁷ A more precise definition of spatiotemporal coincidence is needed given relativistic physics, but I set aside that complication for now.

⁸ See Fine (2006, 209) for discussion of a related case involving weight instead of mass.

⁹ See Olson (2009) and Sutton (2014) for the closely related “too many thinkers” argument for animalism. See Cutter (forthcoming) for an appeal to such cases to argue against physicalism.

¹⁰ Simchen (2023) uses a similar case to object to hylomorphism about actions under what he calls “the moral ledger problem.”

¹¹ See Dasgupta (2013), Eddon (2013a, 2013b), Field (1980), Mundy (1987), Perry (2015, 2024), Turner (forthcoming), and Wolff (2020) for discussion of the metaphysics of quantities.

in the way that such quantities of distinct entities typically add up. This is the problem of surplus for pluralism.

The Problem of Surplus: We are pressured to posit too great an amount of quantities instantiated at a given spacetime region.¹²

In section II, I show why existing solutions to the problem of surplus fail before using logical parthood to advocate a unified solution in section III. In sections IV and V, I demonstrate how my solution to the problem of surplus can be extended along multiple dimensions.

Before discussing how at least some monists (where monists are those who typically deny the existence of distinct, colocated entities) face a similar problem in section IV, I focus on how the problem of surplus arises for *abundant* pluralist proposals, proposals that posit a multitude of colocated objects. I focus specifically on material plenitude. I follow Maegan Fairchild’s (2019) initial characterization of material plenitude: “the material world is in some sense full to the brim with coincident objects” (144). Material plenitude maintains that there is a distinct entity for every eligible modal profile.¹³ Fairchild focuses on developing material plenitude for objects. Uriah Kriegel (2024) formulates an account of event plenitude.¹⁴ Fans of plenitude typically take *a lot* of modal profiles to be eligible—enough to generate at least billions of colocated entities.

My discussion centers on abundant pluralism for two reasons. First, abundant pluralism is especially threatened by the problem of surplus. The abundant pluralist is in danger of not only positing an extra 40kg of mass in University Statue, but presumably at least billions of kilograms of surplus mass given how many distinct, colocated objects they acknowledge.

Second, abundant pluralism has the resources to confront difficult puzzles. Karen Bennett (2004) appeals to material plenitude to solve the grounding problem, which demands an explanation for why colocated objects fall under different sortals or have different “sortalish” properties. Bennett uses material plenitude to defend a primitivist response. She claims, “[i]f all of the possible modal profiles are instantiated, the question [of why entities have the modal profiles they do] simply does not arise. Thus the fullness of each spatio-temporal region explains—or at least explains away—the primitiveness of the *de re* modal facts.” (2004, 355)

¹² The problem of surplus resembles other metaphysical puzzles, especially the hard problem of the many (Simon (2017), Cutter (forthcoming)) and the problem of personites (cf. Johnston (2016a)(2016b), Kaiserman (2019), Eklund (2020)). The hard problem of the many challenges the physicalist to explain why there are not too many conscious experiencers (and conscious experiences) generated by distinct, partially overlapping physical objects. The problem of personites challenges the perdurantist to explain how the properties (especially the value) of a person and their temporal parts relate to one another. I lack the space to examine whether my solution to the problem of surplus can extend to the hard problem of the many or the problem of personites.

¹³ See, for example, Bennett (2004), Dorr & Hawthorne with Yli-Vakkuri (2021), Fairchild (2019, 2020, 2023), Sider (ms.), and Yablo (1987) for formulations of plenitude.

¹⁴ Some fine-grained theories of events, such as Kim’s (1976) plausibly count as versions of event plenitude.

Leslie (2011) and Dorr & Hawthorne with Yli-Vakkuri (2021) use material plenitude to solve puzzles of modal tolerance. Puzzles of modal tolerance claim that objects can survive a series of small modifications but not certain major changes. The Eiffel Tower can always be a few centimeters shorter, but it cannot be 2 cm tall. The plenitudinist maintains that the Eiffel Tower is colocated with a multitude of other objects, all with different modal profiles. Some can survive the small changes while others cannot. Given the utility of abundant pluralism and the fact that the problem of surplus is particularly salient for abundant pluralism, my discussion focuses on and is tailored to abundant pluralism in sections II and III.

II. Unsuccessful Responses to the Problem of Surplus

A. Is there an easy solution to the problem of surplus?

An easy solution to the problem of surplus would be to adopt a blanket policy like the following: We never aggregate the quantities of distinct, colocated entities.¹⁵ This solution is natural and appealing when we consider the physical quantities of colocated objects that mereologically overlap.¹⁶ When determining how much mass is in our lap, we would not sum the mass of the cat with the mass of its paw. If the statue and clay have all the same material parts, the thought goes, we should not sum their mass either.

The easy solution fails when generalized. Sometimes the quantities of colocated objects and events aggregate. We aggregate normative quantities in the following example (modified from an example Loets (2021a) provides for a different purpose):

- (4) **Sports Betting:** Irving the soccer referee is involved in illegitimate sports betting. He decides to throw the game to receive a bribe from a corrupt gambler. At minute 32 of the game, Irving gives a particular hand signal. In doing so, Irving delivers two messages: He signals to the players that one of them is offside (a bad call—no one was offside). Irving also pre-arranged with the corrupt gambler that he will give that hand signal at minute 45 to signal that he is taking the gambler's bribe. There are at least two colocated acts: making a bad referee call and signaling a bribe. The disvalue of both acts compounds. The fact that

¹⁵ I use the term “aggregate” rather than “sum” because it is not merely that the amounts do not sum in accordance with the addition operation. The amounts do not combine in *any* non-trivially way. For instance, the pluralist should not merely deny that the stabbing contributes –50 units of value over and above the quick stabbing. They should deny that the stabbing contributes any additional units of disvalue over and above the disvalue of the quick stabbing. I use “aggregate” to mean “non-trivially aggregate” throughout the paper.

¹⁶ This thought echoes Fine's response treatment of the problem of surplus as regards weight under hylomorphism: “[I]n the weight case, what we should say is that just as the number of objects in two sets is only the sum of the numbers in each of the sets when the sets do not overlap, so the weight of two things is only the sum of the weights of each thing when the things do not materially overlap.” (Fine, 2006, 209).

Irving made a bad call over and above signaling a bribe makes his actions *worse* than they would have otherwise been if he had signaled the bribe without making the bad call.

David Builes (ms., 12) provides an example where the pluralist should aggregate mass and other physical quantities:

- (5) **Bosons:** Steven French (1989) discusses the possibility of distinct bosons that are in the same quantum state. If it is possible to have multiple colocated bosons, then the masses of those two bosons aggregate.

The bosons case is somewhat contentious because, first, we may deny that this scenario features distinct colocated bosons. Some philosophers of physics deny that bosons are objects at all.¹⁷ Second, it is not clear that bosons are mereologically complex. Many discussions of pluralism advocate the existence of distinct, colocated mereological complexes. Pluralists may not extend their position to mereological simples (although see Builes (ms.) for reasoning that they should). Nevertheless, I believe our metaphysical theories should allow that the masses of the bosons can aggregate: to deny this one must either take a controversial stance on the ontology of bosons or limit the scope of pluralism.

The easy solution, which claims that the quantities of colocated entities never aggregate, cannot accommodate the above examples. I seek a solution to the problem of surplus that avoids aggregating quantities in the examples from section I but leaves open that we can aggregate quantities of colocated entities on certain occasions.

B. Too Much vs Too Many: Surplus and Double-Counting

A second attempt to solve the problem of surplus tries to assimilate the problem of surplus to another problem that pluralists face, the counting problem.¹⁸ I argue that existing solutions to the counting problem are not solutions to the problem of surplus.

Pluralism often conflicts with common-sense intuitions about counting objects and events. Most people would say that there is one object in front of them when looking at a paperclip. The plenitudinist maintains there are many entities colocated with the paperclip. The pluralist already has strategies to address the counting problem. We may claim that there are many colocated objects but only a single *paperclip*.¹⁹ Perhaps there is implicit, context-dependent domain-restriction occurring when we say, “There is only a single paperclip on the table.” Such claims are true in some contexts (when the domain is restricted in certain ways) and

¹⁷ Saunders (2006).

¹⁸ I follow Thornton’s (ms.) use of the term “counting problems.”

¹⁹ One option is to pursue a supervaluationist strategy on which there are different precisifications of “paperclip,” each precisification picking out an object with a slightly different modal profile. “There is only one paperclip on the table” will be true under each precisification. See Bennett (2004, 361) for discussion of supervaluationism in this context.

false in others.²⁰ Or we may embrace that claims like “There is one paperclip on the table” are just plain false and provide an error-theory for why people think, speak, and behave as if there is only a single paperclip on the table.

I doubt that addressing the counting problem and the problem of surplus together using one of the above strategies is the correct starting point. Both strategies above admit, at least in the metaphysics room, that there are multiple colocated entities even if we don’t ordinarily speak that way. Were we to offer a similar response to the problem of surplus, it would serve as another type of “easy” solution: we admit that the quantities of all the colocated entities aggregate (at least in the metaphysics room), and we explain why people tend not to think, speak, and behave as if they aggregate.

Such an approach cannot yet distinguish cases where aggregating quantities is warranted from cases where it is unwarranted. Aggregating the quantities of colocated entities in every case has other unacceptable consequences as well. Consider a pluralist position that takes every person to be distinct from a colocated human animal but denies that all human animals are colocated with persons: Perhaps persons possess the essential feature of having higher-order desires, and not all human animals are colocated with entities with higher-order desires.²¹ Now suppose that there are two (non-colocated) human animals eating ice cream, but only one of them is colocated with a person. If we aggregate in both cases, we are pressured to claim that there is more pleasure where the person is than where the non-person human animal is. But that is incorrect: there is no reason to think that there is less pleasure in one location than in the other.²² Thus, not only should we not *speak* as if the pleasure aggregates, we should also deny that the pleasure aggregates in the first place.

C. Ontological Privilege and Its Complications

A more promising way to try to solve the problem of surplus and the counting problem together is to appeal to what Uriah Kriegel (2022) calls “elitism.” According to elitism, there is one entity among the colocated entities that is ontologically privileged. We only count the privileged entity. When we determine how much mass, consciousness, and value are in a particular location, we only determine the quantities possessed by the privileged entity.

²⁰ See Liebesman (2020) and Dorr & Hawthorne with Yli-Vakkuri (2021). See Kriegel (2019) for discussion of how plenitude interacts with theories of proper names.

²¹ Frankfurt (1971) has the classic formulation of this account of personhood.

²² The above example assumes that there are a finite number of coincident entities, but we face trouble if there are infinitely many colocated entities as well. Suppose each entity colocated with Bertha experiences 30 hedons. And consider a person standing next to Bertha, Martha. Martha is hooked up to a pleasure-machine that delivers 2 million hedons to its experiencer. Martha, like Bertha, is colocated with infinitely many distinct beings. There is an infinite amount of pleasure in Martha’s location as well as in Bertha’s location. The pluralist who always aggregates in the metaphysics room will say that there is the same amount of pleasure experienced where Martha is located and where Bertha is located. That judgment is wrong; there is much more pleasure in Martha’s location than there is in Bertha’s location.

However, I show that elitism cannot solve the problem of surplus either. Kriegel formulates a plausible elitist proposal using laws of nature:

Laws of Nature Elitism: For any coincident-plenum of coincidents $x_1 \dots x_n$, there is among $x_1 \dots x_n$ a unique coincident x_u to which the laws of nature apply.²³

Laws of Nature Elitism avoids overcounting mass in University Statue because the laws only treat one of the coinciding objects as having mass. So, according to Laws of Nature Elitism, there is only 40kg of mass on the quad when the statue resides there—even though the statue is colocated with distinct objects.

Using Laws of Nature Elitism to avoid surplus mass is not as straightforward as it initially appears. One problem: some views take physical quantities to be instantiated in virtue of the causal or nomological roles that the quantities play. That is, there is no mass, charge, or other physical quantities if their instantiation is not subject to the laws of nature.²⁴ But if the laws of nature only take one object among the colocated to have mass, then the other colocated objects would not have mass or other physical quantities. This is problematic if pluralism is a view about coinciding *material* objects because it's questionable whether objects lacking mass or other physical quantities count as material objects.

A second problem: as mentioned above, we are sometimes in danger of having surplus mass (University Statue), and we sometimes willingly aggregate the mass of colocated objects (Bosons). It is not clear how Laws of Nature Elitism can be sensitive to cases where we aggregate mass and cases where we do not.²⁵ It is natural to claim that in the case of Bosons, we have *two* elite entities (each boson). But if so, the elitist solution has not gotten us very far: we still must provide an account of whether and when we have multiple elite colocated entities and when we have a single one.

A third problem is that laws of nature are only relevant to scientific quantities. Laws of nature govern neither mental nor normative properties. One thought is to extend Laws of Nature Elitism so that it incorporates other types of laws or principles. For example, we can formulate:

Psychological Laws Elitism: For any coincident-plenum of conscious coincidents $x_1 \dots x_n$, there is among $x_1 \dots x_n$ a unique coincident x_u to which the psychological laws apply.

And:

Moral Laws Elitism: For any coincident-plenum of coincidents $x_1 \dots x_n$, there is among $x_1 \dots x_n$ a unique coincident x_u to which the moral laws apply.

²³ Kriegel's formulation is inspired by Hawthorne's (2006) discussion of how the dynamical laws can separate "quality" and "junk" objects. I drop the restriction to dynamical laws here.

²⁴ See, for example, Hawthorne (2002) and Berenstein (2016).

²⁵ Builes (ms.) raises additional difficulties for constructing empirically adequate formulations of laws of nature under plenitude.

These versions of elitism prevent aggregation in Fratricide and Ice Cream Cone. In Fratricide and Ice Cream Cone, the elite entity (whatever it is) will have –50 units of value and 30 hedons, respectively.

Psychological Laws and Moral Laws Elitism also accommodate the intuitions behind Sports Betting. Suppose the elite event in the case of Sports Betting has the modal profile of being *necessarily both an act of bad refereeing and signaling a bribe*. Presumably, that event has (what we would ordinarily think of as) the compounded disvalue of a bad referee call and of signaling a bribe. The suggestion is for the moral and psychological laws to recognize the entity that has what we would ordinarily think of as the aggregated quantity.

I added the “what we would ordinarily think of as” qualifier above because, on the elitist proposal, the bribe-signal and the bad call do not individually have disvalue. These versions of elitism therefore cannot respect certain judgments about inheritance. We would typically judge that the event that is both a bribe-signal and bad call inherits its disvalue from the disvalue of the bribe-signal event and the disvalue of the bad call event.

These versions of elitism also seem *ad hoc*: Why think that the elite entities are ones with modal profiles like *necessarily both an act of bad refereeing and signaling a bribe*? Such modal profiles do not reflect particularly natural categories. It is surprising that our laws only recognize such entities.²⁶

III. The Logical Parthood Constraint

A. Logical Parthood

A more satisfying solution to the problem of surplus arises once we recognize the utility of the notions of logical implication and its converse, logical parthood. David Lewis used logical implication when developing his metaphysics of events,²⁷ but the utility of logical implication and logical parthood in preventing surplus has largely gone unrecognized. First, I explain Lewis’s motivation for using logical implication. Then, I show how we can extend his characterizations of logical implication and logical parthood to solve the problem of surplus before arguing that logical implication and parthood are useful for monists as well.

²⁶ Kriegel (2022) discusses another version of elitism, but it suffers the same and additional problems. It takes one object among the coinciding entities to be the most metaphysically fundamental and takes the other coincidents to ontologically depend on the most fundamental one. Yet, it is not clear that there will always be one object or event that is more fundamental than the rest of its coincidents. Especially if we have infinitely many coinciding objects or events, what would prevent each of them from ontologically depending on other coincidents? Furthermore, our earlier concerns return. What non-*ad-hoc* reason do we have to think that the most metaphysically fundamental entity in Sports Betting has the modal profile *necessarily both an act of bribe-signaling and making a bad call*? This proposal also cannot respect our judgments about aggregation if only the elite entity possesses quantities.

²⁷ See “Events” in Lewis (1986).

Lewis is a pluralist about events. One of his examples is that of a conference that is colocated with an invisible goblin battle. Lewis distinguishes the conference from the goblin battle by theorizing that events are properties, or classes, of possible spacetime regions. Because there are possible regions where the conference occurs but not the battle and *vice versa*, they are not the same event.

Lewis's account also distinguishes the stabbing and the quick stabbing because there are possible regions where the stabbing occurs, but it is not quick. But Lewis is not content to treat the stabbing and the quick stabbing as *wholly* distinct. He worries that we may be led to count an event "twice over." (1986, 256)

To differentiate such events, Lewis introduces the notion of event implication:

Event 1 *implies* event 2 iff necessarily if event 1 occurs exactly in a specific region, event 2 occurs exactly in that region.

When event 1 implies event 2, the events share their exact location. When one event implies another, Lewis describes the latter as a "logical part" of the former. Lewis's insight is that events standing in the logical implication relation are non-identical but not wholly distinct. We can use that insight to deny that the quantities of logically implied and logically implying events aggregate.

Lewis's terminology of "logical *parthood*" to describe the converse of logical implication is illustrative given a salient similarity between logical parthood and mereological parthood. We do not aggregate the quantities possessed by an event and its logical parts just as, in the case of objects, we do not aggregate the quantities of an object and its mereological parts. In determining how much mass is in a region where a basketball is located, we take the mass of the fusion to include the masses of its parts, and the total mass in the region is just the mass of the fusion, i.e. the mass of the basketball. We reached the same judgment when considering whether to sum the mass of the cat and the mass of its paw in section II.

Similarly, when one event logically implies the other, the latter is a logical part of the former, and we do not aggregate the quantities possessed by the two events. We take the total amount of the quantity in the region to be the amount possessed by the implying event. Let us examine how to use logical implication to solve the problem of surplus in the case of events before extending the proposal to objects:

If event e_1 implies event e_2 , where both events occur in exactly region R , and both e_1 and e_2 possess quantity Q in the amounts of Q_1 and Q_2 respectively, then the total amount of Q in $R = Q_1$.

Consider Fratricide. The event of a quick stabbing in region R implies the event of a stabbing in region R . Each of the quick stabbing and the stabbing is worth -50 units of value. So, by our principle, there are only -50 units of value in region R , which is the correct result.

Fratricide differs from Sports Betting. In Sports Betting, the event of signaling the bribe in region R does not imply the event of making a bad referee call in region R . There are worlds

where Irving signals a bribe in region R but does not make a bad referee call. Suppose that the game is at halftime in another possible world. Irving's hand signal is not a bad referee call in that world; nevertheless, we suppose that it still signals a bribe to his cronies in the stands. In other possible worlds, Irving makes the bad referee call without signaling a bribe—perhaps he just makes a careless mistake. So, neither signaling the bribe nor making the bad call logically implies the other. We are permitted to aggregate the disvalue of the events.

We can extend Lewis's account of event implication to object implication to address the other examples.

Object 1 implies object 2 iff necessarily if object 1 exists in a specific region R,²⁸ object 2 exists in R.

We now formulate the constraint as follows, where both events and objects count as entities:

The Logical Parthood Constraint: If entity x_1 implies entities $x_2 \dots x_n$, $x_1 \dots x_n$ are all the entities located in region R with quantity Q, and $x_1 \dots x_n$ possess quantity Q in the amounts of $Q_1 \dots Q_n$ respectively, then the total amount of Q in R = Q_1 .

The Logical Parthood Constraint generates the correct result in the cases above. Let's first consider Bosons, an example where quantities do aggregate. The bosons are not necessarily colocated; each boson could exist without the other. So, neither boson implies the other boson. Because our condition only prohibits surplus when we have object implication, we are not prohibited from aggregating the mass of the colocated bosons. This is the correct judgment: we must consult our physical theories to determine whether the masses of the bosons aggregate.

The Logical Parthood Constraint also accommodates Ice Cream Cone and University Statue. Bertha may not imply the Bertha-animal because, on certain conceptions of personhood, Bertha the person could survive the death of her physical body. Likewise, it's perhaps possible that the Bertha-animal exists when Bertha the person does not. The Logical Parthood Constraint prohibits overcounting even when neither entity implies the other: Bertha and the Bertha-animal are implied by a third colocated object—the one that is necessarily both the Bertha-animal and person, or a *personified human animal*.²⁹ Given that the organism that is necessarily both the Bertha-animal and person experiences 30 hedons, there

²⁸ When an object “exists in” a region, I assume that the object is exactly located at a spatial region at a time. We must be more careful about how to define exact location in relativistic settings (Gilmore (2006)).

²⁹ What kind of modal profile is this? The idea is that the personified human animal is more fragile than both the human animal and person. It would not survive any condition that would destroy the person nor would it survive any condition that would destroy the human animal. So, the object with this modal profile will not survive the death of their animal body, it will not survive severe memory loss (if we adopt a psychological-continuity account of personhood), and so on. Entities are generally more fragile than their logical parts.

are only 30 hedons of pleasure in the Bertha region.³⁰ Likewise, even if the statue does not imply the existence of the clay (if the statue could have been made of different material), there is another colocated object—the object with the modal profile of being necessarily a clay statue—that implies both the statue and the clay. Given that the mass of the clay statue is the same as the mass of the clay and the mass of the statue, the mass in their location is 40kg.³¹

A clarification: My aim is not to determine how much of a particular quantity each coinciding entity possesses. Determining how much of a quantity each individual coincident possesses is ultimately a task for our metaphysical theories conjoined with our specific theories of physical, mental, and normative quantities. Instead, my aim is to prevent overcounting the quantities possessed by the coincident objects. In other words: You tell me how much of a quantity each coincident has, and I will tell you why the quantities don't add up in a horrendous way. The Logical Parthood Constraint accomplishes that objective. The pluralist can now admit that all colocated entities have quantities and that these properties do not aggregate in problematic cases.

It's important to note that for the Logical Parthood Constraint to deliver the right verdict in cases (1)-(3), there must be a “top dog” entity with the quantity that implies the rest of the entities possessing the quantity. The examples I have considered so far are oversimplified: for instance, in Ice Cream Cone, the *personified human animal* was the stand in for the top dog, but I only considered the relationship between three entities. Of course, the abundant pluralist will posit many additional colocated entities. When there are many (perhaps infinitely many) colocated entities, which one is the genuine top dog? What essential properties does the top dog have?

I take the top dog to have the most robust essence among the colocated entities, where essence is understood intensionally for now: essential properties are those that entities possess necessarily. A “modal profile” of an entity demarcates the properties the entity possesses essentially (necessarily) and the properties the entity possesses accidentally (contingently). To find the “top dog” entity, we can use Fairchild's theory of modal profiles. Fairchild understands the modal profiles of distinct coinciding objects using the notion of a neutral property. Here is her “simple” characterization of plenitude:

Simple Plenitude: Necessarily, given any material object *o* and any modal profile *M* based on all of *o*'s neutral properties, there is something coincident with *o* which has *M*. (155)³²

³⁰ The Logical Parthood Constraint is better suited to abundant pluralism than it is to more modest forms of pluralism. If we only countenance two colocated objects, Bertha and the Bertha-animal, then there is no third colocated object that implies both.

³¹ If the statue is necessarily made from the clay, then the statue logically implies the clay. I use “the clay” as shorthand for the object with the modal profile of necessarily being made of clay.

³² Simple Plenitude is not Fairchild's ultimate characterization of plenitude. We must use Fairchild's later characterizations to avoid certain problems, but the details of those problems and the sophisticated formulations of plenitude that avoid those problems are not directly related to issues

A property is *neutral* iff necessarily, for all x and y , if x and y coincide then Fx iff Fy . (154). Presumably, physical properties like mass, temperature, and electric charge count as neutral. Simple Plenitude entails that there is an object for every way of sorting the entity's neutral properties into the essential and accidental categories. Take the following oversimplified and unrealistic example: Suppose we have an object that only has two neutral properties, mass and temperature, essentially. There is a coinciding entity that has only mass essentially, one that has only temperature essentially, and one that has neither essentially. These four objects have four different modal profiles.

Fairchild's account of Simple Plenitude tells us which entity among the coinciding entities has the most robust nature: it is the one that possesses all its neutral properties essentially. Given Simple Plenitude, the top dog entity is the entity with quantity Q that has the most robust essence—i.e. the one that has the modal profile dictating that the most of the entity's neutral properties are essential. This is easiest to determine in cases where every coinciding entity possesses quantity Q : the top dog, in that case, is the entity that has *all* of its neutral properties essentially. In cases like University Statue, where all coinciding entities have 40kg mass, the top dog will be the 40kg object that has all its neutral properties essentially.

In cases where the entity that has all its neutral properties essentially *lacks* Q , we must continue our search for the top dog. In such a case, the top dog is the one with Q that possesses the most of its neutral properties essentially. This adds a wrinkle to the proposal: In cases where some colocated entities lack Q , there may not be a single top dog. If there is no top dog, then the Logical Parthood Constraint fails to apply. That is not problematic in and of itself. Bosons is one such case where there is no top dog, and we welcome aggregation in that case.

A problem arises for the Logical Parthood Constraint if there are situations where there is no top dog and we want to automatically prohibit aggregation. I cannot think of any such examples, but it would be nice to have a strategy in case such cases arise! *If* cases arise where there is no top dog and we want to prohibit aggregation, we can still use a version of the Logical Parthood Constraint to make partial progress. Call the new version "Logical Parthood Constraint Lite." The Logical Parthood Constraint Lite states that when entities stand in the logical parthood relation to each other, we should not sum *their* quantities. Unfortunately, the Logical Parthood Constraint Lite will not definitively tell us how much of a quantity is in a location, but it can at least explain why we should not aggregate the quantities of entities like those in cases (1)-(3). Hopefully, there are no examples where we want to prohibit aggregation and have no top dog, but at least now we have a game plan if they arise. For now, I will continue to discuss the original Logical Parthood Constraint.

The Logical Parthood Constraint is significant because it allows us to advance a variety of pluralist positions—ones concerning radically different types of entities possessing radically

we face in the problem of surplus. As there will be no change in how we define the top dog across Fairchild's characterizations of plenitude, I continue to use Simple Plenitude for ease of reading (keeping in mind that we should ultimately substitute her final formulation of plenitude to avoid the other problems that concern Fairchild).

different types of quantities—at once. We now see that versions of the problem of surplus concerning physical, mental, and normative properties admit of a common solution.

The Logical Parthood Constraint solves the problem of surplus while avoiding the trouble that Elitism faces. The Logical Parthood Constraint straightforwardly acknowledges that all the coincident entities have the quantities in question. All the stabbings have disvalue, all the ice cream eating brings pleasure, all the objects colocated with the statue have mass, and so on. We can therefore avoid the charge of *ad hocness*; we do not mysteriously single out one entity as having the quantity in question.

The Logical Parthood Constraint also respects our aggregation judgments when quantities do aggregate. The amount of disvalue possessed by the bribe-signal and bad referee call is the aggregate of the amount of disvalue of the bribe-signal and the amount of disvalue of the bad referee call. The proposal allows that entities have the quantities they do in virtue of the quantities of their logical parts.³³

Additionally, logical implication and logical parthood are not mysterious notions. Neither notion forces the pluralist to accept any untoward ontological posits nor do they require that the pluralist subscribe to any conception of metaphysical fundamentality or ontological privilege. The pluralist, and anyone comfortable with metaphysical modality, should already have logical implication and parthood in their metaphysical toolkit.

I now show that there are two valuable ways to extend the characterization of logical implication. The first extension demonstrates that logical implication and parthood are important notions for monists as well as pluralists. The second extension shows we can develop a hyperintensional rather than intensional conception of logical implication using the resources of truthmaker semantics. I motivate the hyperintensional extension by describing how examples of necessary coincidents challenge the intensional Logical Parthood Constraint. Both extensions expand the utility of logical implication and parthood.

IV. Logical Implication for Monists

Even those who deny pluralism will find logical implication and logical parthood valuable. Monists—those who typically deny the existence of distinct, coincident entities—often adopt what Fine (2003, 212-218) calls “the predication-shift strategy” to address puzzles of coincidence. For example, instead of distinguishing the statue and clay because the statue is fragile while the clay is not, the predication-shift strategy states that there is a single object and that the properties attributed to the object will change across contexts. For example, when we say that Goliath is fragile, our predicate “fragile” picks out the property *fragile as a statue*. And when we say the clay is not fragile, our predicate “fragile” picks out *fragile as a piece of clay*. Goliath is not fragile as a piece of clay. We depict the same object (Goliath) in our

³³ Note that the Logical Parthood Constraint does not force us to accept this dependence claim.

claims ascribing and denying fragility to him, but our predicate “fragile” shifts in the sense of picking out different properties.

Given an abundance of such predicates, these monists face a problem with quantities that mimics the problem of surplus. Consider monist analogues of Fratricide and Sports Betting. The monist claims that there is only one act that is Romulus’s stabbing of Remus. Romulus’s act is worth –50 units of value as a quick stabbing and it is worth –50 units of value as a stabbing, we suppose. The disvalue does not compound. The monist also claims that Irving only performs one action in the monist version of Sports Betting. Irving’s action is disvaluable insofar as it is a bad call, and it is disvaluable insofar as it is a bribe signal. But in monist Sports Betting, the disvalue compounds. Even though both the monist versions of Fratricide and Sports Betting feature a single action, the monist still must explain why we aggregate value differently in the two examples.

I suggest that the monist consider properties such as *being worth –50 units of value as a stabbing* to be quantitative relational properties. I follow Loets’ (2021b) formulation of relational “*qua*” properties to understand the form of quantitative relational properties. A relational “*qua*” property has the form of *being an F as a G*.³⁴ We have witnessed two relational properties of Goliath above: *fragile as a statue* and *fragile as a piece of clay*.

Quantitative relational properties share the same form except that a quantity occupies the F position. Quantitative relational properties therefore have the form: *having Q as a G*. For example, in *having –50 units of value as a stabbing*, *Q* is the determinate quantity, *–50 units of value*, and *G* is *stabbing*. Another quantitative relational property is *experiencing 30 hedons as a human animal*. Here, *Q* is *30 hedons* and *G* is *human animal*.

We can extend our notion of logical implication as follows:

Quantitative relational property *Q₁ as a G₁* implies quantitative relational property *Q₂ as a G₂* iff “x is a G₁ in region R” metaphysically necessitates “x is a G₂ in region R.”

The Monist Logical Parthood Constraint: If *Q₁ as a G₁* implies (*Q₂ as a G₂ Q_n as a G_n*), *G₁...G_n* are exhaustive, and x instantiates the properties *Q₁ as a G₁ Q_n as a G_n*, then the total amount of quantity *Q* possessed by x is *Q₁*.

G₁...G_n are exhaustive when they are the only roles we can slot into the “G_x” position such that the entity has quantity *Q as a G_x*. The exhaustivity condition secures *Q₁ as a G₁* as the monist’s “top dog” property. As in the pluralist’s case, I do not have a proof that there will be a top dog, but it seems plausible that in cases lacking a top dog we should be permitted to aggregate.³⁵

³⁴ Loets (2021b) is focused on “*qua*” qualification, and note that she uses the “*qua*” rather than “as a” locution in her definition of relational qua-properties: “Qua-Properties: For a to be F-*qua*-G is for a to be a G which bears F-*qua* to G.” (Loets (2021b), 8).

³⁵ If there are cases where there is no top dog property but we want to automatically prohibit aggregation, we can fall back on a monist “lite” alternative as we did in the pluralist case. The Monist

Because the property *−50 units of value as a quick stabbing* implies the property of *−50 units of value as a stabbing*, we do not aggregate in the monist’s analogue of Fratricide. But because neither *−50 units of value as a bribe signal* nor *−50 units of value as a bad call* implies the other, we are permitted to aggregate in the monist’s analogue of Sports Betting. The monist can use logical implication and parthood to avoid surplus as well.

V. From Logical Implication to Hyperintensional Logical Implication

While the Logical Parthood Constraint (and its monist variant) prevents surplus in the core examples, it struggles to accommodate cases where entities necessarily coincide. The challenge for the Logical Parthood Constraint is that entities may necessarily coincide, and thereby imply each other, but their quantities aggregate. The examples below are speculative but worth considering because logical implication need not be characterized intensionally; it can be understood hyperintensionally. The broader our characterization of logical implication, the wider the application it can have. The discussion below is exploratory as I want to show the reader that there are multiple promising ways to develop a hyperintensional characterization of implication.

Consider “clingly” bosons that are necessarily colocated but distinct. Clingly bosons logically imply each other, but their masses should still aggregate, contrary to the Logical Parthood Constraint. Similarly, suppose that every human is colocated with an invisible demon that has its own mental states. Mary and the demon Horace live independent mental lives even though they are tethered spatiotemporally (and perhaps materially) to each other. Suppose further that Mary and Horace each enjoy watching episodes of *The White Lotus*: Both receive 50 hedons of pleasure from watching the show. The Logical Parthood Constraint predicts that there are only 50 hedons in Mary’s location while they watch an episode when there should be 100 hedons.

While the above cases are more speculative than the ones discussed previously, the solution to the problem of surplus should be sufficiently flexible to accommodate necessary coincidents. I suggest that we develop a hyperintensional modification of the constraint by appealing to truthmaker semantics. There are two alternatives for using truthmaker semantics to develop a hyperintensional characterization of logical implication. I describe each and leave it to the reader to determine which is preferable.

Truthmaker semantics is an alternative to possible-worlds semantics that allows us to distinguish the content of propositions that logically entail one another. Our entry point to truthmaker semantics is the recognition that propositions such as “ $2 + 3 = 5$ ” and “ $8 * 4 =$

Logical Parthood Constraint Lite requires that whenever Q_1 as a G_1 implies Q_2 as a G_2 , we do not aggregate Q_1 and Q_2 in determining the total mass of their bearer.

32” metaphysically necessitate each other but their contents differ. Possible worlds semantics cannot easily explain how their contents differ because it identifies a proposition with the set of possible worlds in which the proposition is true. Given that “ $2 + 3 = 5$ ” and “ $8 * 4 = 32$ ” are true in every possible world, possible worlds semantics cannot straightforwardly distinguish their contents. Truthmaker semantics has recently been advanced (in part) to capture these hyperintensional differences.

Truthmaker semantics has been developed in several ways.³⁶ I follow Fine’s (2012, 2017) approach. Truthmaker semantics postulates a state-space, a parthood relation over the state-space, and verification and falsification relations holding between states in the state-space and propositions: following Fine (2019), I identify a state-space with an ordered pair $(S, \sqsubseteq)$ where S is a non-empty set of states and $\sqsubseteq$ is the binary parthood relation. $\sqsubseteq$ is a partial order on S ; i.e., where s, t and u are states, $[\text{parthood}]$ is such that the following three principles hold:

1. Reflexivity: $s \sqsubseteq s$
2. Anti-symmetry: If $s \sqsubseteq t$ and $t \sqsubseteq s$ then $s = t$
3. Transitivity: If $s \sqsubseteq t$ and $t \sqsubseteq u$ then $s \sqsubseteq u$ ³⁷

We delimit the semantic content of propositions by taking states to stand in “exact verification” and “exact falsification” relations to propositions. The content of a proposition is determined by the states that exactly verify it. States exactly verify or falsify propositions when the state is *wholly relevant* to the truth or falsity of the proposition (2014). The state *the apple is red* is an exact verifier of the proposition “The apple is red.” And the state, *the apple is red* is an exact falsifier of the proposition, “The apple is green.”

States exactly verifying a proposition necessitate the truth of the proposition. But a state’s necessitating the truth of a proposition does not entail that it exactly verifies the proposition. For instance, “Black tea contains caffeine” necessitates “ $2 + 2 = 4$ ” but the state verifying the former proposition does not verify the latter because the state verifying “Black tea contains caffeine” is not wholly (or partly) relevant to the truth of “ $2 + 2 = 4$.” Where lowercase letters ($s, t, u, \dots$) represent states, and ($A, B, C, \dots$) represent individual propositions, we say:

State s exactly verifies $A \equiv_{\text{df}} s \models_v A$

And:

³⁶ See for example, Abreu Zavaleta (2019, 2023), Angell (1989), Correia (2004), Elgin (2021), Fine & Jago (2019), Fine (2012, 2013, 2014, 2017), Gemes (1993, 1994), Moltmann (2015, 2017, 2018, 2019, 2020), van Fraassen (1969), and Yablo (2014).

³⁷ I also assume that S is closed under fusion so that that any subset of S has a least upper bound in S , and that this is a “modalized” state space, i.e. I will not countenance impossible states below.

State s exactly falsifies $A =_{df} s \models_f A$

An atomic proposition is exactly verified by any possible state s whose obtaining is wholly relevant to the truth of P . An atomic proposition is exactly falsified by any possible state whose obtaining is wholly relevant to the falsity of P . Following Fine (2012, 2017), the following clauses demonstrate how states exactly verify truth-functional conjunctions, disjunctions, and negations:

- (i) $s \models_v \neg B$ if $s \models_f B$
- (ii) $s \models_v B \wedge C$ if for some states t and u , $t \models_v B$, $u \models_v C$, and $s = t \sqcup u$
- (iii) $s \models_v B \vee C$ if $s \models_v B$ or $s \models_v C$

Intuitively, some propositions contain others as part of their content. “Cats purr and meow” contains “Cats purr” as part of its content. And “Cats purr and meow” does not contain “ $2 + 3 = 5$ ” as part of its content even though the former proposition necessitates the latter. Given the background framework, I can now define *content-parthood* which I use in the first hyperintensional characterization of implication:

C is part of the content of A if and only if:

1. Every possible state that exactly verifies A contains a possible state that exactly verifies C .

And:

2. Every possible state that exactly verifies C is contained in a possible state that exactly verifies A .³⁸

Conjunctive propositions contain their conjuncts as parts. “ $A \& B$ ” contains “ A ” as a part because the state exactly verifying “ $A \& B$ ” is the fusion of the state verifying “ A ” and the state verifying “ B .” And every state verifying “ A ” is contained in at least one possible state that verifies $A \& B$. Moreover, the proposition “ $2 + 3 = 5$ ” does not contain “ $8 * 4 = 32$ ” as a part even though both propositions are necessarily true: they are verified by different, non-overlapping states.

With this characterization of content-parthood, I define hyperintensional implication (implies- h_1):

Entity x_1 implies- h_1 entity x_2 iff “Entity x_1 is in region R ” contains “Entity x_2 is in region R ” as a content part.

The Hyperintensional₁ Logical Parthood Constraint: If entity x_1 implies- h_1 entities $x_2 \dots x_n$, $x_1 \dots x_n$ are all the entities existing in region R with property Q , and

³⁸ Fine (2017, 641).

$x_1 \dots x_n$ possess quantity Q in the amounts of $Q_1 \dots Q_n$, respectively, then the total amount of Q in $R = Q_1$.

Using our definition of content parthood and certain background metaphysical assumptions that should be reasonable to the abundant pluralist, it is plausible that the state exactly verifying “The clay statue is in region R ” presumably contains as parts states exactly verifying “The statue is in region R ” and “The clay is in region R .” Likewise, the state verifying “Bertha the personified human animal is in region R ” will contain as parts the states verifying “Bertha the person is in R ” and “Bertha the animal is in R .”

Clingy Boson 1 does not imply-h₁ Clingy Boson 2, even though they necessarily coincide, because the truthmakers for propositions concerning Clingy Boson 1 do not include, even in part, truthmakers for propositions concerning Clingy Boson 2 just as truthmakers for “ $8 * 4 = 32$ ” do not include a truthmaker for “ $2 + 3 = 5$ ” even though both propositions are modally equivalent. Stating exactly *why* the state verifying “Clingy Boson 1 exists” does not contain the state “Clingy Boson 2 exists” as a part may require us to delve deeper into the metaphysics—and into our other hyperintensional resources. Here is a start: Even though Clingy Boson 1 is necessarily colocated with Clingy Boson 2, the relational property, *being colocated with Clingy Boson 2*, is not part of Clingy Boson 1’s constitutive essence in Fine’s sense. It does not make Clingy Boson 1 the entity that it is in the sense that it does not directly define Clingy Boson 1. The properties that directly define Clingy Boson 1 will presumably include ones like its mass, charge, and so on. Thus, “Clingy Boson 1 is in region R ” does not include “Clingy Boson 2 is in region R ” as a part.

Matters are more complicated in some of the other examples. “The quick stabbing is in region R ” presumably has “the stabbing is in region R ” as a content part, but the state verifying “The quick stabbing is in region R ” is not a straightforward fusion of the state verifying “The stabbing is in region R ” along with another state because there is difficulty in determining what the other state could be. This difficulty also arises with propositions invoking quintessential determinate and determinable properties. For example, “The scarf is scarlet” presumably includes “The scarf is red” as a content part, but the verifier of “The scarf is scarlet” is not straightforwardly a fusion of states verifying the scarf is red and another state. More specific propositions seemingly include states verifying more general propositions as proper parts, but it is not always clear what the other proper parts for the verifiers for specific propositions could be.

There are multiple suggestions for accommodating determinable and determinates in a truthmaker semantics framework that we can import here. For instance, Abreu Zavaleta (2023) proposes an understanding of states using a conception of psychological naturalness under which determinate states are parts of determinable ones. We may also seek to preserve

that the more general propositions are content parts of the more specific propositions by denying certain supplementation principles on the state space.³⁹

If one does not wish to take a stand on whether determinate states are parts of determinable states, there is an alternative way to develop a hyperintensional implication without invoking content parthood. We can use Mark Jago's (2020) notion of refinement. Jago suggests "that states may stand to one another in a non-causal relation of determination or refinement. That I have a brother determines that I have a sibling. That the box is scarlet determines that the box is red. In each case, the former refines the latter, making it more precise. The notion I have in mind is related to the traditional determinate/determinable classification. But (as I intend the notion and unlike on the traditional one) distinct determinates need not exclude one another: I may have both a sister and a brother, with each state individually determining that I have a sibling." (687)

The idea here is that more specific states refine the more general ones they fall under. We can utilize Jago's notion of refinement as follows:

Entity x_1 implies- h_2 entity x_2 iff the states exactly verifying "Entity x_1 is in region R " refine the states exactly verifying "Entity x_2 is in region R ."

The Hyperintensional₂ Logical Parthood Constraint: If entity x_1 implies- h_2 entities $x_2 \dots x_n$, $x_1 \dots x_n$ are all the entities existing in region R with property Q , and $x_1 \dots x_n$ possess quantity Q in the amounts of $Q_1 \dots Q_n$, respectively, then the total amount of Q in $R = Q_1$.

The state verifying "The quick stabbing is in region R " refines the more general state verifying "The stabbing is in region R ." Thus, the quick stabbing implies- h_2 the stabbing which explains why their disvalue does not aggregate. But "Clingy Boson 1 is in region R " does not refine "Clingy Boson 2 is in region R " because states involving Clingy Boson 1 are not refinements of states involving Clingy Boson 2. Clingy Bosons 1 and 2 do not stand in any specification relations to each other. Depending on whether one prefers to use the notion of content-parthood or refinement, there are two options for accommodating the possibility of necessary coincidents.

The Hyperintensional Logical Parthood Constraints share the advantages of the Logical Parthood Constraint. We can still maintain that all coincident objects have the quantities in question while avoiding the problem of surplus. While truthmaker semantics is less familiar to metaphysicians than possible worlds semantics, truthmaker semantics does not encourage us to reify states or adopt a metaphysically primitive truthmaking relation. Truthmaker semantics is on an ontological par with possible worlds semantics: Just as the metaphysician has options for how to understand the nature of possible worlds, the metaphysician has

³⁹ Following Fine (2011), one formulation of supplementation states that If s is a proper part of t then some non-null part of t is disjoint from s . If we deny such supplementation principles, we can still uphold that the state verifying "the stabbing is in region R " is a proper part of the state verifying "the quick stabbing is in region R " even if the latter state does not have a disjoint proper part.

options for how to understand the nature of possible states and exact verification and falsification. For those eager to distinguish the content of modally equivalent propositions and for those willing to countenance necessary coincidents, the hyperintensional logical parthood constraints are helpful tools.

VI. Conclusion

Without a way to prevent overcounting quantities, our metaphysical theories would be in a dire state. They—especially abundant pluralism—would posit vastly greater amounts of properties like well-being, value, pleasure, mass, and electric charge than our normative, psychological, and physical theories permit.

I argued that the existing solutions to the problem of surplus face a series of issues: The solutions are either insufficiently general, cannot distinguish cases where quantities aggregate from cases where they do not, or rely on contentious assumptions about ontological privilege. I suggested that we use the notions of logical implication and its converse, logical parthood, to provide a general solution to the problem of surplus without incurring dubious ontological commitments. I also showed how the monist can appeal to a logical parthood constraint to solve the version of the problem of surplus that arises for them, and I explored two ways to extend logical parthood constraints to accommodate hyperintensional differences and necessary coincidents.

Consequently, the problem of surplus is not a reason to fear abundance. We may posit a myriad of colocated entities without being in danger of positing too great a sum of quantities alongside them. Similarly, the monist may posit an abundance of quantitative relational properties without fearing aggregation either. The logical parthood constraints ensure we do not have too much on our plate.

References

- Abreu Zavaleta, M. (2019). Communication and variance. *Topoi*, 40(1), 147–169.
- Abreu Zavaleta, M. (2023). Partial understanding. *Synthese*, 202(2), 1–32.
- Angell, R. B. (1989). Deducibility, entailment, and analytic containment. In J. Norman & R. Sylvan (Eds.), *Directions in relevant logic* (pp. 119–143). Kluwer Academic Publishers.
- Aristotle. (1941). Metaphysics. In W. D. Ross (Ed.), *The basic works of Aristotle*. Random House.
- Baker, L. R. (1997). Why constitution is not identity. *Journal of Philosophy*, 94(12), 599–621.
- Bennett, K. (2004). Spatio-temporal coincidence and the grounding problem. *Philosophical Studies*, 118(3), 339–371.
- Berenstein, N. (2016). What a structuralist theory of properties could not be. In A. Marmodoro & D. Yates (Eds.), *The metaphysics of relations* (pp. 157–176). Oxford University Press.
- Builes, D. (manuscript). A dilemma for plenitude.

- Carmichael, C. (2020). How to solve the puzzle of Dion and Theon without losing your head. *Mind*, 129(513), 205–224.
- Correia, F. (2004). Semantics for analytic containment. *Studia Logica*, 77(1), 87–104.
- Cutter, B. (forthcoming). The many-subjects argument against physicalism. In G. Lee & A. Pautz (Eds.), *The importance of being conscious*. Oxford University Press.
- Dasgupta, S. (2013). Absolutism vs comparativism about quantity. *Oxford Studies in Metaphysics*, 8, 105–150.
- Davidson, D. (1963). Actions, reasons, and causes. *Journal of Philosophy*, 60(23), 685–700.
- Descartes, R. (1984). *Meditations on first philosophy* (S. Twayman, Ed.). Caravan Books. (Original work published 1641)
- Dorr, C., Hawthorne, J., & Yli-Vakkuri, J. (2021). *The bounds of possibility: Puzzles of modal variation*. Oxford University Press.
- Eddon, M. (2013a). Fundamental properties of fundamental properties. In K. Bennett & D. W. Zimmerman (Eds.), *Oxford studies in metaphysics* (Vol. 8, pp. 78–104). Oxford University Press.
- Eddon, M. (2013b). Quantities. *Philosophy Compass*, 8(7), 633–645.
- Eklund, M. (2020). The existence of personites. *Philosophical Studies*, 177(7), 2051–2071.
- Elgin, S. Z. (2021). Knowledge is closed under analytic content. *Synthese*, 199(1–2), 5339–5353.
- Fairchild, M. (2019). The barest flutter of the smallest leaf: Understanding material plenitude. *Philosophical Review*, 128(2), 143–178.
- Fairchild, M. (2020). Varieties of plenitude. *Philosophy Compass*, 15(3), 1–11.
- Fairchild, M. (2023). Plenitude, coincidence, and humility. *Philosophical Perspectives*, 36(1), 59–77.
- Field, H. H. (1980). *Science without numbers: A defence of nominalism*. Princeton University Press.
- Fine, K. (1982). Acts, events and things. In W. Leinfellner (Ed.), *Language and ontology: Proceedings of the Sixth International Wittgenstein Symposium* (pp. 97–105). Holder-Pichler-Tempsky.
- Fine, K. (1999). Things and their parts. *Midwest Studies in Philosophy*, 23(1), 61–74.
- Fine, K. (2003). The non-identity of a material thing and its matter. *Mind*, 112(446), 195–234.
- Fine, K. (2006). Arguing for non-identity: A response to King and Frances. *Mind*, 115(460), 1059–1082.
- Fine, K. (2011). An abstract characterization of the determinate/determinable distinction. *Philosophical Perspectives*, 25(1), 161–187.
- Fine, K. (2012). Counterfactuals without possible worlds. *Journal of Philosophy*, 109(3), 221–246.
- Fine, K. (2013). A note on partial content. *Analysis*, 73(3), 413–419.
- Fine, K. (2014). Truth-maker semantics for intuitionistic logic. *Journal of Philosophical Logic*, 43(2–3), 549–577.
- Fine, K. (2017). A theory of truthmaker content I: Conjunction, disjunction and negation. *Journal of Philosophical Logic*, 46(6), 625–674.
- Fine, K. (2022). Acts and embodiment. *Metaphysics*, 5(1), 14–28.
- Fine, K., & Jago, M. (2019). Logic for exact entailment. *Review of Symbolic Logic*, 12(3), 536–556.
- Frankfurt, H. G. (1971). Freedom of the will and the concept of a person. *Journal of Philosophy*, 68(1), 5–20.
- French, S. (1989). Identity and individuality in classical and quantum physics. *Australasian Journal of Philosophy*, 67(4), 432–446.

- Gemes, K. (1993). Hypothetico-deductivism, content, and the natural axiomatization of theories. *Philosophy of Science*, 60(3), 477–487.
- Gemes, K. (1994). A new theory of content I: Basic content. *Journal of Philosophical Logic*, 23(6), 595–620.
- Gilmore, C. (2006). Where in the relativistic world are we? *Philosophical Perspectives*, 20(1), 199–236.
- Goswick, D. (2018). The Hard Question for Hylomorphism. *Metaphysics* 1 (1):52–62.
- Hawthorne, J. (2002). Causal structuralism. *Noûs*, 35(s15), 361–378.
- Hawthorne, J. (Ed.). (2006). *Metaphysical essays*. Clarendon Press.
- Horden, J., & López de Sa, D. (2024). People and places. *Noûs*, 58(4), 1137–1155.
- Jago, M. (2020). Truthmaker semantics for relevant logic. *Journal of Philosophical Logic*, 49(4), 681–702.
- Johnston, M. (1992). Constitution is not identity. *Mind*, 101(401), 89–106.
- Johnston, M. (2016a). Personites, maximality and ontological trash. *Philosophical Perspectives*, 30(1), 198–228.
- Johnston, M. (2016b). The personite problem: Should practical reason be tabled? *Noûs*, 50(4), 617–644.
- Kaiserman, A. (2019). Stage theory and the personite problem. *Analysis*, 79(2), 215–222.
- Kim, J. (1976). Events as property exemplifications. In M. Brand & D. Walton (Eds.), *Action theory* (pp. 310–326). Reidel.
- Korman, D. Z. (2020). The metaphysics of establishments. *Australasian Journal of Philosophy*, 98(3), 434–448.
- Koslicki, K. (2008). *The structure of objects*. Oxford University Press.
- Koslicki, K. (2018). *Form, matter, substance*. Oxford University Press.
- Kriegel, U. (2019). Essentialist plenitude and the semantics of proper names. *Metaphysics*, 2(1), 16–25.
- Kriegel, U. (2022). Egalitarian vs. elitist plenitude. *Philosophical Studies*, 179(10), 3055–3070.
- Kriegel, U. (2024). Event plenitude. *Synthese*, 204(2), 1–16.
- Kripke, S. (1972). Naming and necessity. *Tijdschrift Voor Filosofie*, 45(4), 665–666.
- Leslie, S.-J. (2011). Essence, plenitude, and paradox. *Philosophical Perspectives*, 25(1), 277–296.
- Lewis, D. (1986). *Philosophical papers* (Vol. 2). Oxford University Press.
- Liebesman, D. (2020). Double-counting and the problem of the many. *Philosophical Studies*, 178(1), 209–234.
- Loets, A. J. (2021a). Qua objects and their limits. *Mind*, 130(518), 617–638.
- Loets, A. J. (2021b). Qua qualification. *Philosophers' Imprint*, 21(27).
- Menn, S., & Smith, J. E. H. (Eds.). (2020). *Anton Wilhelm Amo's philosophical dissertations on mind and body*. Oxford University Press.
- Moltmann, F. (2015). States versus tropes: Comments on C. Anderson and M. Morzycki: 'Degrees as kinds.' *Natural Language and Linguistic Theory*, 33(3), 829–841.
- Moltmann, F. (2017). Partial content and expressions of part and whole: Discussion of Stephen Yablo: Aboutness. *Philosophical Studies*, 174(3), 797–808.
- Moltmann, F. (2018). An object-based truthmaker semantics for modals. *Philosophical Issues*, 28(1), 255–288.
- Moltmann, F. (2019). Nominals and event structure. In R. Truswell (Ed.), *The Oxford handbook of event structure*. Oxford University Press.
- Moltmann, F. (2020). Truthmaker semantics for natural language: Attitude verbs, modals, and intensional transitive verbs. *Theoretical Linguistics*, 3, 159–200.
- Mundy, B. (1987). The metaphysics of quantity. *Philosophical Studies*, 51(1), 29–54.

- Olson, E. T. (2009). An argument for animalism. In J. P. Lizza (Ed.), *Defining the beginning and end of life: Readings on personal identity and bioethics*. Johns Hopkins University Press.
- Passinsky, A. (2021). Norm and object: A normative hylomorphic theory of social objects. *Philosophers' Imprint*, 21(25), 1–21.
- Paul, L. A. (2002). Logical parts. *Noûs*, 36(4), 578–596.
- Perry, Z. R. (2015). Properly extensive quantities. *Philosophy of Science*, 82(5), 833–844.
- Perry, Z. R. (2024). On mereology and metricality. *Philosophers' Imprint*, 23.
- Plantinga, A. (2007). Materialism and Christian belief. In P. van Inwagen & D. Zimmerman (Eds.), *Persons: Human and divine* (pp. 99–141). Oxford University Press.
- Plato. (2002). *Phaedo* (D. Gallop, Trans.). Oxford University Press.
- Rea, M. C. (1998). Sameness without identity: An Aristotelian solution to the problem of material constitution. *Ratio*, 11(3), 316–328.
- Saunders, S. (2006). Are quantum particles objects? *Analysis*, 66(1), 52–63.
- Sider, T. (2001). *Four-dimensionalism: An ontology of persistence and time*. Oxford University Press.
- Sider, T. (manuscript). Plenitude and derivative ontology.
- Simchen, O. (2023). Acts and morals. *Metaphysics*, 6(1), 45–59.
- Simon, J. A. (2017). The hard problem of the many. *Philosophical Perspectives*, 31(1), 449–468.
- Sutton, C.S. (2014). The Supervenience Solution to the 'Too-Many Thinkers' Argument. *Philosophical Quarterly*, 64 (257): 619–639.
- Swinburne, R. (2014). What makes me, me? A defense of substance dualism. In A. Lavazzo & H. Robinson (Eds.), *Contemporary dualism: A defense* (pp. 139–153). Routledge.
- Swinburne, R. (2019). *Are we bodies or souls?* Oxford University Press.
- Thomson, J. (1983). Parthood and identity across time. *Journal of Philosophy*, 80(4), 201–220.
- Thornton, Z. (manuscript). What counts in counting?
- Turner, J. (forthcoming). The metaphysics of mixed quantities. *Noûs*.
- van Fraassen, B. C. (1969). Facts and tautological entailments. *Journal of Philosophy*, 66(15), 477–487.
- Wiggins, D. (1968). On being in the same place at the same time. *Philosophical Review*, 77(1), 90–95.
- Witt, C. (2011). *The metaphysics of gender*. Oxford University Press.
- Wolff, J. E. (2020). *The metaphysics of quantities*. Oxford University Press.
- Yablo, S. (1987). Identity, essence, and indiscernibility. *Journal of Philosophy*, 84(6), 293–314.
- Yablo, S. (2014). *Aboutness*. Princeton University Press.
- Zimmerman, D. (2010a). From experience to experiencer. In M. C. Baker & S. Goetz (Eds.), *The soul hypothesis: Investigations into the existence of the soul* (pp. 168–196). Continuum Press.
- Zimmerman, D. (2010b). From property dualism to substance dualism. *Aristotelian Society Supplementary Volume*, 84(1), 119–150.