Fabio Patrone

The simplicity of identity

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The semplicity of identity

PADOVA UP

To Anna and Nina.
As *simple* as that.

I will touch only once
and you'll know it's furtive.
It's as useless to call me
as to recall me.
You'll have plenty of time
to tell yourself over and over again
about this moment,
and to try and convince yourself
that we rest against each other.

Tangent[1]

[1] All the epigraphs are from "Euclidians" of Eugène Guillevic, Unicorn Press, Greensboro (1975); translation by Teo Savory.

Contents

0. Introduction

There are many things in this world. Ourselves, for a start. And then the objects we use, things we do, entities we relate to. We travel on trains, immerse ourselves in books, and exchange greetings. It seems foolish to doubt all this. However, sometimes philosophers delve into theories that transcend our everyday notions, pushing our understanding to the brink of absurdity. This discrepancy between the philosophy room and the real world is not always a far-fetched exercise in style. I think this is particularly true for a metaphysical thesis that unifies three highly counterintuitive ideas on the market, presenting a surprisingly coherent and harmonious narrative. I do not expect to convince you that either of these views is true or that the general view is true. What I do hope is to show that the acceptance of one of those counterintuitive theses leads to endorsing the others.

The general view results in a five-dimensional world composed of point-sized entities, pixels, which are not connected through parthood relations. I am looking at the keyboard I am typing on. It is clear to me that it is composed of parts. In fact, "the letter Q is part of the keyboard" seems a very plausible way of describing the world as it is. Nevertheless, a plausible description does not always have the character of necessity, primarily when representing the world as it is rather than the

world as it seems, i.e., as we perceive it. As Sider (2011: i) points out, «for a representation to be fully successful, truth is not enough; the representation must also use the right concepts, so that its conceptual structure matches reality's structure».

The relation between wholes and parts seems to be an excellent example of this tension between perception and metaphysical representation of the world. Our intuitive cognitive categorization of reality as a catalog of entities (wholes) composed of parts, which, in turn, are made of smaller parts, and so on, is explained by classical mereology. Even if its application provides a solid formal apparatus for understanding the complex structure of our world, when we describe reality in mereological terms, such as that things have parts or that entities are glued together as wholes, we do not simply provide (just) a logical explanation; we are taking a metaphysical stance towards the way entities move along space, time, and even possible worlds. Take what Hume (1985: 79) says:

> «These twenty men *may be consider'd as a unite*. The whole globe of the earth, nay, the whole universe *may be consider'd as an unite*. That term of unity is merely a fictitious denomination, which the mind may apply to any quantity of objects it collects together».

This quote perfectly represents the fundamental nature of the apparent counterintuitive description of the world I defend in this book. In fact, it is an old philosophical habit to challenge our intuitions. This is precisely what pixelism does. This metaphysical account evaluates composition, persistence through time, and modality homogenously. Pixels do not spatially compose and do not diachronically persist. Instead, they are linked by counterpart relations in different worlds, at different times, or regions of space.

This idea brutally clashes with common sense. After all, we have daily experience with persisting and composite objects. When I brush my teeth and look in the mirror, I see myself as the same person I was yesterday and who I will be tomorrow. And when I drive my Vespa I think it is the same motorcycle I bought years ago. We experience the persistence of things every day. I am sitting on a chair (a compound of wooden pieces) now, typing on a computer (a very sophisticated composite object), and eating a sandwich (bread + artichokes + mayonnaise). I, myself, am a composite object! How is the pixelist world-view even possible? The answer is that persistence and composition occur only fictionally.

Consider the screen of your computer. It works by having millions of pixels. A pixel is the smallest addressable element of what is represented on a screen. The images you see on it result from the process involving each pixel. Each pixel represents the smallest portion of what you see on the screen. The result is a combination of the characteristics of all the single pixels that we unify perceptively as a unique image. I will employ this example to develop two models of a metaphysical view I call "pixelism", namely the conjunction of exdurantism, mereological nihilism, and counterpart theory. Pixelism's world-view consists of a world of single entities, which are combined (both spatially and temporally) only fictionally in our everyday lives. This is not to say that does not exist anything, but simply that relations among the, so to speak, bricks of reality are ultimately mind-dependent and that, in turn, objects appear to be mind-dependent as well. Reality is made of various combinations of pixels arranged chair-wise, cat-wise, and skyscraper-wise. The temporal dimension is analog to the spatial one in all respects. It can be efficiently illustrated with a geometri-

cal model in which entities are four-dimensional pixels in a four-dimensional Euclidean space – as I will present in chapter four. Moreover, if we add a further dimension, the modal one, we can describe a five-dimensional world in which all the coordinates have the same characteristics. The modal analog of mereological nihilism and radical exdurantism is counterpart theory, i.e., the thesis according to which entities are world-bound individuals.

As pixels do not actually "merge" to depict what you see on the screen, exdurantist entities do not go under temporal composition, and nihilistic entities do not go under spatial composition. My idea is to develop this analogy into two models for pixelism. There are two viable options: the first one takes pixels to be hypercubes, i.e., four-dimensional cubes, which is conditional on accepting extended simples. The second one considers pixels as points in a four-dimensional space.

Such geometrical depictions have many advantages. First, they provide a way to consider under a different light the metaphysical implications of pixelism; second, they permit to analyze the modal implications of such a theory effortlessly; third, they show the elegance of pixelism: ultimately, entities persist, compose, and exist in different worlds in the same way, namely as pixels in a five-dimensional space, which consists in the three spatial coordinates, the temporal one and the modal one.

To argue in favor of pixelism, I begin by considering what might be referred to as a form of commonsense ontology. Indeed, without requiring much dialectical effort, if we were to ask an unfamiliar passerby on the street, "What exists in the world?", we would likely receive a response along the lines of: "There is what there is." While this might be an appropriate response to an ambiguous question, it invites further reflection. Granted that only

what exists exists, one might then inquire: In what manner does what exists exist? At this point, the answer becomes more tangled. Of course, one could respond that what exists exists precisely in the way it exists, but such an answer is unlikely to satisfy.

In this vein, I consider three kinds of things: individuals, groups of such individuals, and the things these individuals do, namely events. Individuals are somewhere else called "objects", "substances", or simply "things". Rocks, human beings, ships, microwaves, and so on are individuals. On the other hand, groups are arrangements of individuals. Basketball teams, neighborhoods, encyclopedias, mountain chains, and so on are groups. Events are generally described as "what happens". Hand waves, climbings, agings, smiles, and so on are events.

In our everyday experience of the world, we have no doubts that these entities, whether individuals or groups, engage in activities and that these activities, roughly speaking, exist. If two teams meet in a gymnasium with a basketball and behave in a certain way, we would naturally conclude that "a basketball game is taking place." Similarly, if we think about the final moments of Caesar's life, it would not seem strange to assert that Brutus's act of stabbing occurred.

Usually, a distinction is drawn between physical objects (the conjunction of individuals and groups) and events. Despite that, many philosophers, from Russell (1927) to Quine (1950), from Goodman (1951) to Lewis (1986) and classic four-dimensionalists like Heller (1990) and Sider (2001b), believe there is not a real distinction. According to them, objects would simply be monotonous events, and events would be unstable objects[1], or, in other words, « are not to be distinguished from events, or, in

[1] Goodman (1951, 259).

the concrete sense of the term, processes. Each comprises simply the content, however heterogeneous, of some portion of space-time, however disconnected and gerrymandered»[2]. As it will become clear reading the next pages, I count myself in this group.

Starting from this ontological picture, I present two principles, namely the "Generality of identity" and the "Generality of diachronic identity". According to the former, identity is a simple, general, absolute, and basically unproblematic relation. The latter considers identity over time, asserting that it is a general relation that equally applies to different ontological domains. If the two principles are correct, then we need a metaphysics that can provide a unified treatment of all the phenomena of persistence.

In the second chapter, I claim that this metaphysics corresponds to a *radical* form of exdurantism. By doing that, I provide reasons to suspect that other metaphysical theories, namely endurantism and perdurantism, are not viable alternatives. On the one hand, I emphasize that endurantism cannot offer the unified framework suggested by "Generality of diachronic identity". On the other hand, I acknowledge that perdurantism, while a suitable option for those who wish to support the unified treatment, may have problems in a perspicuous characterization of the relation between temporal parts. For this reason, I introduce a version of exdurantism that rejects mereological universalism—that is, the thesis that, for any given set of entities, there is at most one entity composed of them.

In the third chapter, I argue that radical exdurantism should adopt the same attitude toward spatial relations as it does toward temporal relations. In this sense, I propose that exdurantism, as described, naturally aligns with

[2] Quine (1960:171).

mereological nihilism as its stance toward composition. In fact, according to mereological nihilism, entities never compose spatially. What commonsense identifies as composite objects are atomic entities arranged in a particular way. This means that, for example, chairs do not exist. Instead of them, as van Inwagen (1990) famously argues, there are atomic entities arranged chair-wise. On the one hand, radical exdurantism claims that there are only instantaneous entities that persist fictionally; on the other, mereological nihilism states that there exist only atomic entities that compose fictionally.

The fourth chapter is devoted to analyzing this metaphysical package. In the first part, I describe two geometrical models for pixelism. Both are four-dimensional Euclidean spaces composed of the three spatial and temporal dimensions. Within these models, in the second part, I depict the modal relations between entities by adding a fifth dimension, namely the modal one. Ultimately, according to pixelism, everything is simple. Entities persist, compose, and exist in different worlds in the same way, namely as pixels in a five-dimensional space, consisting of three spatial coordinates, the temporal one and the modal one.

1. The Complexity of Identity

You, with depth
on your surface.

Depth based
on a single level
of surface

and not a bit of leakage
into any volume.

Perfectly plain
in your depth,

in the motionless see-saw
nourishing you.

Depth in you
each of the points
for the other points making you circle.

Boredom
vanquished.

Circle

Frege argues that there is a significant difference between claiming that the morning star is identical to the evening star, and that the morning star is identical to itself. He famously aims at explaining why identity statements differ from self-identity ones, within the distinc-

tion between "sense" and "reference"[1]. Frege's issue of informativeness of identity statements awakens a further philosophical question. In fact, one can wonder how the morning star is possibly identical to the evening star, given that the first appears in the east before sunrise and the second is visible in the western sky only at nightfall. In other words, as Heraclitus pointed out, how can one and the same thing have different properties?

This question lays the foundation of the metaphysical study of persistence through time and change. To persist means to be the same entity at different times, presumably with different properties. In this sense, "identity" and "change" become central to the metaphysical research. In this chapter, I will present these basic concepts, defending the idea that identity is a general matter and introducing the "Generality of Identity" principle. Following this line of reasoning, generality can be described in two ways: (i) general as common and (ii) general as elementary. Common for the same concept of identity belongs to all things and is elementary since, as Lewis (1986) states, there cannot be real problems with identity because identity is basically unproblematic. Nevertheless, as Quine (1982, 208) points out, «despite its simplicity, identity invites confusion».

From a formal point of view, identity is indeed an uncomplicated concept: everything is identical to itself (and to nothing else) – pace Priest *et al.* (1997) and Routley (1980). To support the idea of generality, in the first section, I will introduce three examples of persisting entities, namely objects, groups and events. In the second section, I will present four of the classical puzzles of identity through time and change, which will be helpful in all the following chapters. In the last part of the chapter,

[1] Cf. Frege (1892).

after introducing a further principle, namely the "Generality of Diachronic Identity", I will consider the classic debate about persistence through time. I will depict the difference between the three theses on the market – endurantism, perdurantism, and exdurantism – and, in the second chapter, I will propose that the exdurantist way is more palatable since it is the best option for the supporters of the generality of diachronic identity.

1.1 Three cases

Consider the world you live in and start to enumerate what there is. You may probably begin with a broad list of items: persons, houses, showers, computers, cats, books and so on and so forth. In principle, if you had enough time and will, you would finish naming all these sorts of objects. And what then? Maybe you will start thinking that other kinds of things also exist. If persons exist, shouldn't groups of persons, like soccer teams, be counted in our catalogue? Following this intuition, you might start to count not only soccer teams but also nations, companies, flocks, neighborhoods, sheaves, etc.

But then, one might argue that all the things you have counted also *do* things. Ficus trees grow up, sheep flocks go around grazing, some people play games, and some others occupy areas by force of arms. At the end of the day, you will probably be eager to count yet another kind of thing, namely what we usually call events. For this reason, you will also enumerate basketball games, the lives of prawns, the aging of parents, and so on.

Even if this catalog does not appear to be entirely accurate, it shows that three kinds of things might be considered: individuals, groups, and events. This is in line with our everyday experience. Outside the Philosophy

Department, we always deal with the world through these three kinds of things, without doubting whether trees exist, soccer teams endure, or concerts take place. Even though we unproblematically accept them in our everyday ontology, the persistence of these entities raises many interesting philosophical questions. For example, is a person the same if she changes her somatic traits? Is a company the same if it merges with another? Will the soccer game that was suspended yesterday be the same as the remaining part that will be played tomorrow? To pursue the argument, it is worth providing some illustrative examples for each of the aforementioned ontological categories. Hopefully, the reader will be driven to consider the idea that identity is a general matter among events ("The game"), groups ("The band"), and individuals ("The Morning Star").

1.1.1 The game

Jeff: "It's unbelievable Mike! The game has completely changed in the last two minutes."

Mike: "You're right Jeff. In the first quarter the Knicks and Lakers have been so close. Few but good shots."

Jeff: "The game has been quite boring, though, until LeBron decided to turn it into a completely different thing."

Mike: "He got 23 points in ten minutes, crazy!"

Jeff: "Yeah, oh yeah. Let me tell you something: there have been two different games. One from the beginning to the half of the third quarter and the other from that very moment on."

Mike: "Definitely. And, at a closer look, in the first part of the game, there have been at least three different parts: the one in which Brunson scored three baskets in a row (and when it seemed everything was

going well for the Knicks), the one immediately after, when an amazing defense of Miami…"

Jeff: "Yeah Mike, 0 points for the Knicks in four minutes."

Mike: "Exactly! And the last one in which KAT reentered the field and scored two three-point shots."

Jeff: "If we want to be extremely precise, we should say that, within the second section of the first part of the game, there has been…"

Mike: "Don't philosophize too much Jeff and let's get back to the game. Look at that crossover! It seems Brunson does not agree and wants to start a completely different game…"

1.1.2 The band

The Sugababes are a British pop girl group formed in 1998. They had sold millions of records and played all around the world. In 2006, British Hit Singles & Albums named the Sugababes the most successful female act of the 21st century with six UK number-one singles and eighteen UK top ten hits. They racked up six number-one singles, "Freak Like Me", "Round Round", "Hole in the Head", "Push the Button", "Walk This Way", and "About You Now"; the Spice Girls are the only British girl group to have had more. Sugababes also released five UK top ten albums, four of which reached at least platinum certification in the UK, and have been nominated for six Brit Awards, winning one for Best British Dance Act in 2003. They have been a long-term fixture in the British tabloids due to their several line-up changes and alleged group infighting.

Nonetheless, the discographical success is inelastic to the metaphysical worries one can have towards the Sugababes. Let us take a closer look at their biography. Siobhán Donaghy, Mutya Buena, and Keisha Buchanan

originally formed the band. Their debut album achieved moderate success, peaking at number 26 in April 2001 and becoming certified Gold. In 2001, Donaghy departed the group amid rumors of a rift with Buchanan, and the group was dropped by their record label. With the introduction of Heidi Range, the group began to experience a higher level of commercial success whilst keeping the critical acclaim they had achieved with their debut album. They released three studio albums before Buena announced her departure in December 2005, leading to Amelle Berrabah being brought in to replace her. Following the release of their first greatest hits album, the new line-up released two studio albums. In September 2009, after 11 years in the Sugababes, Buchanan, the last original member, was replaced by former UK Eurovision entry Jade Ewen. Range, Berrabah, and Ewen released the group's seventh studio album, Sweet 7, in 2010, after which they signed to RCA Records before announcing an indefinite hiatus in 2011.

So far, it would seem like the same old pop-group story if the following had not happened: the band's original line-up reformed in 2011 and announced the release of their debut album in 2014. To summarize this unlikely turn of events, the band was formed by three individuals who were gradually replaced by other members. In eleven years, the band changed all its components, and the original members of Sugababes formed another band. It is not a coincidence, though, that the Sugababes' most famous song lyrics go "Can we bring yesterday back around?" and that this very song is contained in a record called "Change".

1.1.3 The Morning Star

The idea was very simple: filming a documentary on Leonardo DiCaprio's life but not the Leonardo DiCaprio the public has seen so far. The real one. The one off-camera. The one brushing his teeth, the one playing with his dogs. And the actor agreed, provided that profits would be given to charity. Given his full agenda, Leo – he told the filmmaker they could call him Leo, said that the documentary could be filmed in two moments only: the evenings and the mornings.

The producer noticed some inconsistencies in the film after the shooting went on, rigorously during the evenings and the mornings only. When he took a closer look, he realized the inconsistencies between the morning and evening scenes. "Isn't it weird?" asked the producer. "Look here: every evening, when he gets home, he's like in one of his movies. It seems he's still acting". The director agreed: "Yep, absolutely true. And it's not the only difference. If you carefully look at all the evening scenes, you can see he's still wearing make-up, with his perfectly tidy hair. Mmmh… It's not working". "What? What is not working?". "The documentary won't work. I was reviewing all the morning scenes, and he's totally different! From a physical point of view, he seems 10 years older… and his attitude towards the cameras is very different. If I was not filming these scenes myself, I would swear they were two different persons!". "Got it! Oh yeah, I got it!" shouted the producer. "What do you have in mind?". "The documentary will be based on this difference: the star in the evening and the star in the morning. I also have the new title for the documentary! Have you ever read Frege?". "Who the heck is Frege?". "Never mind… we'll call it "The Morning Star and the Evening Star. The real story of one and the same star: Leonardo DiCaprio".

1.2 Four puzzles

The examples in the last section underline the many faces of survival through time and change. Our linguistic practice discloses some of our pre-philosophical intuitions: we usually acknowledge that individuals, groups, and events can change even though they remain the same. Nevertheless, our intuitions are not immune to the philosophical analysis.

In this section, I will present four puzzles of the classical literature of the metaphysics of identity through time. They will be useful across the following chapters to analyze and critique classic and non-classic approaches to identity. They are usually discussed to challenge some of our intuitions. The role of the puzzles becomes substantial as they provide reasons to support a certain metaphysics more than another.

1.2.1 The ship of Theseus

After the sensational return from Crete to Athens, Theseus' successful mission inspires the Athenians to keep his ship seaworthy as a memorial to honor Apollo. Call t_1 the time Theseus' ship arrived at Piraeus, the port of Athens. Over time, any wood that wore out or got ruined was gradually replaced with a new one of the same type. Finally, at t_n, there is a ship composed of entirely different planks. Call it Replacement. Now, suppose that a greedy collector got all the old planks that have been substituted and stored in a safe place, far from peekers. At t_n, he decides to build another ship, composed of all and only the planks that belonged to the original ship. Call it Reassembly. Once Reassembly was ready, the collector went to the Athenian authorities. "The ship you're worshipping" said the collector "is not Theseus'. Actually,

I possess the original. Look at the wood your ship is made of: it is brand new. It's only a copy, though very faithful. You're dishonoring Apollo! But don't worry, I am a good man. For a modest price, I can sell you the original ship…". "Calm down, calm down" answered the celebrations supervisor "Ships, like all the other artifacts, survive small changes. This means a ship keeps its identity even if a small piece of it, like a plank, is replaced. I will explain why the original ship is the one we preserved at Piraeus. Consider Ship *1*, Ship *2*, Ship *3*, …, as Theseus' ship with respectively one, two, and three planks replaced, and Ship n as Theseus' ship with all the planks replaced, namely Replacement.

Theseus' ship = Ship *1*
Ship *1* = Ship *2*
Ship *2* = Ship *3*
…
Ship *n-1* = Ship *n* (Replacement)

Therefore, if you accept the fact that a ship can survive small changes, given the transitivity of identity, you have to admit that we have Theseus' ship, and you're only a fraud!". "I see your point, supervisor; but you are wrong, and I will prove it without using any math. Do you accept that a ship, like all the other artifacts, preserves its identity even if it is disassembled and reassembled?". "Of course I do, But I don't see what you are trying to…" "Let me finish" replied the collector. "If you accept that a ship does maintain its identity when it is disassembled and reassembled, then you are forced to say that my ship is the original. After all, I got all and only the original planks of Theseus' ship, and I've reassembled them in the exact same way they were when Theseus brought the ship back to Athens".

This scenario suggests that both the collector and the supervisor are right and, therefore, that both Replacement and Reassembly are identical to Theseus' ship. Nevertheless, we cannot accept this conclusion because it is not the case that a thing is identical to two distinct things (or that the same thing is in two places at once). This paradox is the best-known puzzle case of diachronic identity. It has been discussed since Plutarcus (Parallel Lives, Theseus, 23.1) introduced it, and Hobbes (1655) made it philosophically interesting by adding the "Replacement" ship.

1.2.2 The Wax Museum

The curator of London's Wax Museum has decided to renovate some of its statues. In particular, Michael Jackson's one is the most ruined: too many people handled it, recklessly hugged it, and hung on it to have a picture with a copy of their idol. So, the official sculptor of the museum is appointed to replace the worn statues with new ones as accurately as possible. At time t_1 the work is carried out and there is a brand new wax statue of Michael Jackson, ready to be exhibited. While the sculptor is cherishing his masterpiece, he realizes the horrible mistake he has just made. He has no more lumps of wax to create the last statue on the list, and this one is a priority: Queen Elizabeth II. The museum will reopen in 12 hours, and there is no time to order new wax. There is only one thing to do: destroy Michael Jackson's statue and use its wax to shape Elizabeth II's. At t_2, the sculptor liquefies Michael Jackson's statue; at t3, the Queen's statue is finalized. The curator will not be happy about the inconvenience (neither the visitors, of course), but at least the sculptor has saved the Queen.

At t_1, after the creation of Michael Jackson's statue, the statue and the lump of wax, shaped in statue form, in-

tuitively seem to be one and the same object. They occupy the same region of space, and apparently, they share all their properties: they have the exact same shape, weight, mass, and even the same atomical (and subatomic) structure. We cannot, at t_1, tell the statue apart from the lump of wax and *vice versa*. Nevertheless, it seems that the statue and the lump of wax do not share all their properties. Let t_0 be a time before the sculptor shaped the lump of wax into the statue. At t_0, the statue did not exist, but the piece of wax did. Alternatively, consider the time t_2, when Michael Jackson's statue is liquified to shape Elizabeth II's. In these two cases, the lump of wax still exists, even if not in statue form, and we have no reason to claim it is not the same lump of wax as at t_1. So, the different properties that the statue and the wax have at t_0, t_1, and t_2 suggest that they are not the one and the same object[2]. But how is it possible that there exist two things, like Michael Jackson's statue and the wax that composes it? How can two distinct objects occupy exactly the same portion of space at the same time? This is the so-called "puzzle of constitution"[3].

1.2.3 Tibbles the cat

Consider at t_1 Tibbles, a cat very eager to purr every time one passes by. Tibbles is very cute: he is a yellow-eyed white cat, except for his splendid black tail. Now, take a proper part of Tibbles, called Tib, which con-

[2] We cannot claim identity between things that do not share all their properties because this would violate Leibniz's Indiscernibility of Identicals Principle. I will analyze the relation of identity in section 1.3.

[3] For an overview, see Wasserman [2021]. For opinionated discussions and different solutions, see, among others, Gallois [1998]; Hawley [2001]; Koslicki [2008]; Sattig [2008]; Sider [2001]; Van Inwagen [1990].

sists of the entirety of Tibbles except for the tail. There are no reasons to doubt that Tibbles and his proper part, Tib, are distinct objects. At t_2, Tibbles is wandering outside by night, looking for some food. He recklessly jaywalks while a truck is passing at high speed; thanks to his feline reflexes, he can dodge the impact with the truck but not prevent losing all of his tail in the accident. Even if Tibbles and Tib are distinct at t_1, they coincide at t_2. In fact, given that Tibbles survives the loss of his tail and that we have defined Tib as a proper part of Tibbles composed of all of Tibbles except for the tail, Tibbles and Tib are identical at t_2. As in the other puzzle cases I have presented, the story seems to lead to the conclusion that a thing can be identical to another at one time while being distinct at another. Tibbles' story is also known as the paradox of undetached parts[4].

1.2.4 Amoebic division

Derek enters a space-age machinery called "The Duplicator" that can duplicate his body. The theory behind the process is not so complicated as it is the mechanic version of amoebic division. The device splits Derek's body into two halves and creates the perfect copy of the remaining part of Derek's body for each half. As soon as Derek presses the duplication button, two persons appear in his place. Call them Derek1 and Derek2. The unique feature of the Duplicator is that it duplicates not only the physical characteristic of the object that undergoes the fission. Instead, in the case of people, the Duplicator reproduces also all the psychological traits. If Derek were madly in love with his wife, then both Derek1 and Derek2 would be in love with her. If the very moment before the duplication he wanted a giant pepperoni piz-

[4] Geach (1972); Burke (1994); Wiggins (1980); Sider (2001a).

za, then his clones would crave a giant pepperoni pizza, and so on. Both Derek1 and Derek2 are sufficiently similar to Derek to claim identity. If so, we would have that Derek1 is identical to Derek and that Derek2 is identical to Derek. However, as in the Ship of Theseus' case, this is impossible because Derek1 and Derek2 are distinct, and it is not the case that one and the same thing is identical to two different things. This paradox is known as the fission case[5].

1.3 Identity as a general matter

Asserting the identity of things should not be problematic as all the discussions about identity can be summarized in one line: everything is identical to itself and nothing else. It is true, though, that in our everyday language, we use the term "same" (or "identical") meaning two very different concepts, for example when we say: "You and your mother have the same sweater!" and "It's me, the same person you met five years ago". There are two different kinds of identity: qualitative and numerical. Being qualitatively identical means sharing all properties. Numerical identity, on the other hand, can only hold between a thing and itself. In fact, it has been argued that two things are distinct even if they share all their properties[6]. Consider two Fender Telecaster guitars, built at the same time, with the same equipment, and in the same factory. They are both flame red, have exactly the same shape and the same weight, and, of course, they

[5] The original thought experiment is in Parfit (1971, 1984). It is widely discussed, particularly by Lewis (1983), Noonan (2019), Perry (1972), Shoemaker (1984), Sider (2001a), and Unger (1990). See Olson (2024) for a recent overview.

[6] Consider, for example, Black's (1952) indiscernible spheres.

both sound great. Nonetheless, they are distinct. One of them might be smashed on stage at the end of a concert in Beijing, while the other is played by a Norwegian jazz band in Harlem. In this case, the two guitars are qualitatively identical (considering the moment before they are shipped out of the factory) but numerically distinct.

Given this premise, my work analyzes numerical identity (henceforth, identity). The analyses of the formal concept of identity, provided in the next section, will clarify my claim that identity is a general, simple, and fundamental relation, i.e., the principle of the "Generality of identity". Despite the general characterization of identity as unproblematic, the aforementioned puzzle cases seem to question this idea. In this respect, I will support the idea that this attitude concerns metaphysical rather than formal issues.

1.3.1 Identity

Identity is a cornerstone of philosophy. It has been a significant concept since Parmenides of Elea and Heraclitus' πάντα ῥεῖ, passing through Aristoteles to our days, and it has been extensively analyzed both in logic and metaphysics. The current investigation of identity begins with Gottfried Wilhelm von Leibniz's work. Leibniz (1686) provided a well-known principle, namely "Indiscernibility of identicals". According to it, if two things share all their properties, then they are identical[7].

[7] This principle is also known as one of the so-called "Leibniz's Laws", along with its converse, namely the "Identity of indiscernibles". According to the Identity of Indiscernibles principle, if two things are identical, then they share all their properties. As opposed to Indiscernibility of Identicals, it is a quite controversial statement, which is usually not considered – except for multi-locations bundle theorists, i.e., the ones who believe that the entities that constitute the world are bundles of universals. See O'Leary-Hawthorne (1995).

As generally intended, identity is not affected by the nature of *relata*. This means that regardless of the kinds of things we are considering, identity is one and the same relation. In fact, despite identity being a relation between things in the world, it is a formal matter. Identity is also considered not to be affected by extrinsic factors[8]: whether the original Theseus' ship is identical to Reassembly is true only in virtue of the properties of the original Theseus' ship and Reassembly. It cannot be the case that an external thing, *i.e.*, Replacement, makes an identity statement about the original ship true or false[9].

From a strictly formal point of view, identity is expressed as follows, regardless of the ontological domain:

(1) $a = b$

and it is characterized by the following properties:

(a) *Reflexivity*
(b) Everything is identical to itself.

(c) *Symmetry*
(d) If $a = b$, then $b = a$.

(e) *Transitivity*
(f) If $a = b$ and $b = c$, then $a = c$.

(g) *Indiscernibility of Identicals*

[8] Wiggins (2001, 95-6), Williams (1976, 1-18), Noonan (1985).
[9] That is the core of the paradox. In fact, until Replacement takes place, there is no paradox. If we consider that an artifact like a ship can gradually be subjected to the substitution of its part, we can claim identity between the original Theseus' ship and Reassembly. If not, we consider them two distinct things.

If a = b, then a and b have the same properties.

(h) *No degrees*
(i) a = b or a ≠ b. Identity does not admit degrees.

However, the concept of identity as characterized by (a), (b), (c), (d) and (e) is not widely accepted. For example, reflexivity has been criticized by Routley (1980) and Priest et al. (1997); the principle of transitivity by Geach (1972); the Indiscernibility of identicals by Gallois (1998), Heller (1990), Johnston (1987), and so on. The "No degree" principle has been discussed by Parfit (1971, 1984) within the subject of the identity of persons, and we can intuitively pair it with (a), (b), (c), (d). In fact, the morning Leonardo DiCaprio cannot be 80% identical to the evening Leonardo DiCaprio, keeping in mind that we are now considering numerical identity. While one could share 80% of someone else's properties (*i.e.*, being 80% qualitative identical), one is either 100% identical or not according to the no degrees principle.

While the simplicity of identity is captured by its formal character, the concept's ambiguity is highlighted by the above-mentioned puzzles. Indeed, the cases previously examined seem to cast doubt on whether we can characterize identity as something simple and formally unproblematic. As I will show in the next pages, although there are philosophers that, based on this discrepancy, propose weaker notions of identity, their arguments are not without problems.

1.3.2 The Generality of Identity

Within the statements concerning identity, there is a further one in addition to the qualitative/numerical

distinction. Diachronic identity, or identity over time, is opposed to synchronic identity. Synchronic identity is what Frege has in mind when he considers that the morning star is identical to the evening star. It literally means "identity at the same time", and it is usually intended as the identity of the same thing under different descriptions, *e.g.*, when we say that the 45th President of the United States = the 47th President of the United States, or that the tree heath = erica arborea, Bruto's stabbing = Caesar's death, and so on. Diachronic identity, on the other hand, is what we refer to when we enquire about the persistence of entities through time and change. To recall the examples provided above, diachronic identity refers to questions of the following kind: is Derek identical to Derek_1 after the fission? Are the Sugababes formed in 1998 the same band as the re-formed one in 2011?

This is a general distinction. Outside the Philosophy department, we use the term "identity" to express both synchronic and diachronic identity. It is interesting to note that the relation between synchronic and diachronic identity can be controversial. In fact, when we add time to the identity scenario, the complexity strengthens. Strictly speaking, for something to change, it must remain identical. Despite its intuitiveness, change is a process that seems to conflict with identity. Things change, evolve, mutate, lose parts, age, break. But to change, evolve, mutate, lose parts, age, and break, things must continue to exist; that is, they must persist over time and survive the change. Hence, if we want a metaphysics according to which things endure and remain the same through time and change, we must attempt to fix the problem. Alternatively, we can solve the issue of change by adopting different metaphysics at the cost of rethinking persistence in a new light. This new light involves the abandonment of

the commonsensical concept of "being the same through time" by going as far as to say that diachronic identity is not a genuine case of identity because things do not persist by being identical through time[10].

I will proceed as follows. First, I will introduce the "Generality of Identity" principle. Second, I will present and reject its three main critiques. Finally, I will adduce a further principle, the "Generality of Diachronic Identity," for if diachronic identity is a genuine case of persistence, then the generality of identity spreads to diachronic identity. Consequently, diachronic identity is general, too, i.e., "being identical through time" is the same relation for individuals, groups, and events.

Let us define the "Generality of Identity" principle as the following.

> (GoI) Identity is a general, absolute, and fundamental relation that applies to different metaphysical questions and ontological domains.

The generality of identity is based on the formal character of identity I have described in the previous section. Consequently, the concept of identity adopted by the metaphysical inquiry is the one expressed by (1) and governed by (a), (b), (c), (d), and (e). Whether the Sugababes in 1998 are identical to the Sugabebs in 2011 is a case of (1). And so do the questions presented in the other puzzles.

However, it is not necessary to accept *in toto* (a), (b), (c), (d), and (e) to agree with the generality of identity. For instance, even without accepting (c), the generality of identity principle would still hold as the general, absolute, and fundamental relation described only by (a),

[10] I will present all these metaphysical scenarios in section 1.5.

(b), (d), and (e). And the same dialectic can be iterated for every principle. The generality does not depend on the above-mentioned characterization.

We avail of identity to state that Leonardo DiCaprio is dressed precisely the same way he was yesterday. We use identity to affirm that a soccer team is the same even if it changes five players of the first team, and we need identity to inquire whether an event, like a basketball game, is the same. All these statements involve the same concept, namely, the formal concept of identity. Similarly, there is only one concept of identity at stake in questions regarding personal identity, meta-metaphysical principles, discussions about tropes, the existence of subatomic particles, and so on.

As so characterized, GoI is embraced by many philosophers. This is not to say that GoI is a sort of philosophical dogma. In the next chapter, I will face three different critiques of GoI, addressed by supporters of different kinds of identity.

1.4 Denying Generality

I have presented GoI as an intuitive and almost commonplace principle. However, as well as in every philosophical debate, even the most unruffled intuitions are not exempt from critiques. And it goes without saying that counterintuitiveness is not a viable reason to reject a thesis.

In this section, I will analyze three critiques of the generality of identity. The first one is the famous "Relative Identity thesis", which criticizes the basis of my portrait of generality, *i.e.*, the fact that identity is characterized as a univocal relation. The second is André Gallois' attempt to solve the classic puzzles by using a different

notion of identity, namely "Occasional Identity", according to which a thing can be identical to another at one time and distinct at another time. Finally, I will present a third position by Alan Gibbard, the "Contingent Identity". Gibbard argues that identity statements containing two co-referential terms with different senses could be contingent, so identity would not be necessary.

1.4.1 Against GoI: Relative Identity

Peter Geach (1962, 1972, § 7) affirms that identity is relative. As noted by Noonan (2015), Geach, compares his thesis to Frege's.

> «"x is identical with y" . . . is an incomplete expression. It is short for "x is the same A as y", where "A" represents some count noun understood from the context of utterance – or else it is just a vague expression of a half-formed thought. Frege emphasized that "x is one" is an incomplete way of saying that x is one A, a single A, or else has no clear sense: since the connection of the concepts one and identity comes out just as much in the German "ein und dasselbe" as in the English "one and the same", it has always surprised me that Frege did not similarly maintain the parallel doctrine of relativized identity . . . just briefly stated.» (Geach 1972: 3)

Geach's point is that we cannot simply say that a = b because there is no such thing as a «strict, absolute, unqualified identity» (Geach, 1972, 241). According to him, every time we express an identity statement like

(1) a = b

we literally mean "a is the same F as b", where F is a sortal concept[11], i.e., a kind of thing. In this light, accord-

[11] The same dialectic can be seen in Wiggins (1967) in his reconstruction of Geach's thesis.

ing to Geach, it is possible that a is the same F as b and that a is not the same G as b.

> (RI) a and b are the same F, but a and b are not the same G.

An example is required here. Take the Wax Museum puzzle. In this process of renovation of some statues, the wax of Michael Jackson's statue is used to shape Elizabeth II's. According to the thesis of relative identity, we can assert that:

> (*) Elizabeth II's statue is identical to Michael Jackson's one under the sortal "wax"
>
> and
>
> (**) Elizabeth II's statue is not identical to Michael Jackson's one under the sortal "statue"

Quine (1964: 102) criticizes RI by showing that Geach does not treat genuine cases of identity. In this respect, the relativity of identity is questioned because all the problems raised by Geach are issues of coincidence rather than identity. In fact, the wax constitutes the statue; it is not identical to it.

Geach's position has been extensively discussed over the last century but has rarely found champions in the philosophical community. This is not only because it collides with the commonsensical principle of the generality of identity. Let us examine the reason to endorse the relative identity thesis. Considering sortals as a viable way to treat identity statements does not imply being committed to relative identity[12]. Relative identity is based on sor-

[12] In any case, this attitude is not widely accepted. Even if sortals are considered to play an important metaphysical role, they are character-

tals but is not a direct consequence of accepting sortals: one can embrace the first without necessarily holding the latter. Consider, for example, Wiggins's (1967, 1980) account. Although he supports the idea that identity must always be considered as identity under a sortal, he simultaneously maintains a robust commitment to the absolute nature of identity.

> The fact that there are many different sortal concepts under which one may single out some individual a does not in itself imply relative identity. [...] The reflexivity and congruence of identity provide logically compelling reasons why, if a is b, or if a is the same something or other as b (same horse, same tree, same planet, or whatever), then all different procedures of individuating a (provided they really do individuate a) must, if they yield any answer at all, yield the same answer with respect to a's coincidence with b. Wiggins (2001, 24-5)

Here is his formal argument. The premises are:

(P1) $(\forall x)\left(f(x) \rightarrow \left(\frac{x=x}{f}\right)\right)$[13]

(P2) $(\forall x)(\forall y)\left(\left(\frac{x=y}{f}\right) \rightarrow \phi x \leftrightarrow \phi$

ized in many ways, and the only (almost) uncontroversial application of sortals is their work as a criterion to count things of the same kind ("How many F are there?"). Other applications are: gives a criterion of identity and non-identity among items of that kind; gives a criterion for the continued existence of an item of that kind; answers the question "what is it?" for things of that kind; specifies the essence of things of that kind; does not apply to parts of things of that kind (cf. Grandy (2014)).

[13] The formalism "$\left(\frac{x=x}{f}\right)$" means "x=x under the concept f".

(P1) and (P2) are, respectively, the principle of reflexivity of identity and the principle of Indiscernibility of Identicals applied to relative identity. In fact, relative identity is supposed to be reflexive and to agree with Leibniz's Law. From the thesis of relative identity

(RI) $\left(\frac{a=b}{f}\right) \wedge \neg \left(\frac{a=b}{g}\right)$

follows

(I) $\left(\frac{a=b}{f}\right) \wedge \neg \left(\frac{a=b}{g}\right) \wedge g(a)$.

Now, considering the first conjunct of (RI) and (P2), we have

(II) $\left(\frac{a=b}{f}\right) \rightarrow \phi a \leftrightarrow \phi b$

Take ø to be $\left(\frac{a=x}{g}\right)$, then we have

(III) $\left(\frac{a=b}{f}\right) \rightarrow \left(\left(\frac{a=a}{g}\right) \leftrightarrow \left(\frac{a=b}{g}\right)\right)$.

By (P1) and (I), we have

(V) $\left(\frac{a=a}{g}\right)$

and, by *modus ponens* and (IV)

(VI) $\left(\frac{a=b}{g}\right)$.

Which contradicts (RI)[14].

To save their theory, the only way for the advocates of Relative Identity is to deny the Indiscernibility of Identicals. Again, Wiggins (2001, 27-8) offers four strong reasons to support the Indiscernibility of Identicals principle:

(i) Reflexivity, symmetry, and transitivity are not sufficient to define identity; in fact, there are plenty of other relations that are reflexive, symmetric, and transitive (e.g., exact similarity, weighing the same).

(ii) If two things are identical, how is it possible that they have different properties? This is a very intuitive claim but difficult to rebut.

(iii) If we drop Leibniz's Law, we need another principle to justify all the instances of intersubstitution of identicals that we know are valid.

(iv) Let us suppose that two terms, a and b, refer to an object o and that there is a predicate P such as Pa is true and Pb is false. Suppose again that the predicate P instantiates a property Q. How is it possible that o has and does not have the same property?[15]

Geach's attempt to solve the paradox of identity fails. Quine and Wiggins provide very good reasons to reject

[14] Other classic critics of Relative Identity include Perry (1970) and Stevenson (1972). For recent discussions, see, among others, Gallois (2016) and Noonan & Curtis (2022).

[15] «Suppose there were terms t1 and t2 both designating z, one and the same donkey, and suppose there were a context () such that the result of supplying t1 to it was true and the result of supplying t2 was false. What ought we to say if it were suggested that the open sentence (x) determined a property? Call the putative property Q. We ought to ask: How can the donkey both have and lack the property Q? The question is unanswerable». Wiggins (2001, 28).

his thesis, both from a formal and a conceptual point of view. Nevertheless, the Relative Identity thesis has deeply influenced the debate about identity and persistence, opening the door to other ways to deny the generality of identity.

1.4.2 Against GoI: Occasional Identity

André Gallois (1990, 1998) argues that identity is not an eternal nor a necessary relation. His view opposes the generality of identity, given that he states that a thing can be identical to another at one time and distinct at another. Occasional identity is a kind of contingent identity[16] – Gallois,' defense of occasional identity leads to a defense of contingent identity, although the opposite is not true: the identity of things is not relative to a world but to a certain time. With this move, Gallois aims to provide a better solution to the puzzle cases of identity, avoiding the paradoxes that the general view seems to generate.

Occasional identity can be characterized as follows:

(OI) $(\exists x)(\exists y)(\exists t)(\exists t')(at : x = y \wedge at\ t' : x \neq y)$

Consider the fission case. Gallois' solution is the following: Derek_1 and Derek_2 existed before the division as identical, while they are distinct after the fission occurred. Suppose that, at t_2, Derek_1 is swimming in the pool and Derek_2 is reading a book. Considering a time t_1 before the fission, occasionalists can affirm that

(i) at t_1 Derek_1 = Derek
(ii) at t_1 Derek = Derek_2

and for transitivity of identity

[16] See §1.4.3.

(iii) at t_1: $Derek_1 = Derek_2$

Now, consider $Derek_1$ and $Derek_2$ at t_2. They are clearly two distinct objects: $Derek_1$ is in the pool while $Derek_2$ is inside reading the book. So, we also have

(iv) at t_2: $Derek_1 \neq Derek_2$

Gallois treats $Derek_1$ and $Derek_2$ as temporally quasi-rigid designators. The term "quasi-rigid designator" has been introduced by Lewis (1986, 256) for his counterpart-theoretic semantic notion. Following Kripke (1980)[17] Gallois considers quasi-rigid designators to be a name that designates *x* at one time and *y* at some other time.

He is led to introduce it because if $Derek_1$ and $Derek_2$ were rigid designators, then (iii) and (iv) would be incompatible. At the same time, if they were non-rigid designators, there would be no reason to draw upon occasional identity. In fact, if $Derek_1$ is a synonym for a temporal non-rigid designator like "the tallest man in the pool", then (iii) and (iv) could be true both because $Derek_2$ is actually the tallest man in the pool at t_1 and because some other man became the largest man in the pool once $Derek_2$ started reading the book. That is to say that (iii) and (iv) can be true even if there is nothing like an amoeba identical to another at a time and distinct at another; if $Derek_1$ and $Derek_2$ were non-rigid designators, (iii) and (iv) does not entail (OI).

[17] In Naming and Necessity, Kripke sets the classic distinction between rigid and non-rigid designators. He defines a rigid designator as a term that designates the same object in all possible worlds in which that object exists and never designates anything else. Usually, proper names are always rigid designators. On the other hand, descriptions like "the tallest man on earth" or "the King of France" are non-rigid designators because they do not identify the same individual in all possible worlds.

Occasional identity raises some perplexities. Gallois' poses his argument as a conditional: «If the thesis that there are occasional and contingent identities is coherent, the examples in question are best thought of as examples of occasional identities»[18], but there is no way to make the antecedent true. Indeed, occasional identity is affected by two serious issues: the characterization of the temporally quasi-rigid designator is not as clear as it should be and is not a transitive relation.

Varzi (2001b) notes that quasi-rigid designators are problematic. How can we make sense of statements like

(v) *at t*1: *a* = *b*

if a and b are quasi-rigid designators? Given that the designators Gallois has in mind are temporally-bounded, we have identity statements of the form

(vi) *at t*1: *a at t*1 = *b at t*2

It is unclear how we should manage cases like (v) and, hence, the real consistency of the quasi-rigid designators. In this case, the truth of (vi) does not depend only on whether we take those objects to be the ones denoted by a and b at t1. Furthermore, we cannot take a and b to be the object denoted by the relevant names at the time of utterance because by doing so, we would attribute a truth-value to (i)-(iv) only on the assumption that Derek_1 and Derek_2 exist at the time of utterance (p. 293-4).

Consider transitivity and take a closer look at (i), (ii), (iii), and (iv). Given that (iii) and (iv) collide with transitivity, Gallois adopts a temporally qualified version of transitivity:

[18] Gallois (1998: 6).

$$(T_t)\ (x)(y)(z)(t)((at\ t : x{=}y \wedge at\ t : y{=}z) \longrightarrow at\ t : x{=}z)$$

Since that transitivity should be considered at a certain time, the fact that *at* t_1*:* $Derek_1 = Derek_2$ and *at* t_2*:* $Derek_1 \neq Derek_2$ does not undermine transitivity (as described in (T_t)). However, even if occasionalists face this problem, this does not prevent them from experiencing further transitivity issues. Bader (2012) presents a double-fission plus fusion case to criticize occasional identity. Let us start by recalling Derek's fission case. At t_1, Derek is ready for the fission; at t_2, the fission occurs, and two persons, $Derek_1$ and $Derek_2$, enter the scene. Suppose that Derek has a twin, Derek*, who decides to undergo fission too. So, Derek and Derek* enter the Duplicator together. At t_2, three persons come out of the machine: $Derek_1$, $Derek_{2*}$, and $Derek_3$. $Derek_{2*}$ is the fusion of a product of Derek's fission and a product of Derek*'s one[19].

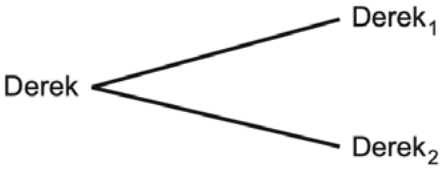


Fig. 1.1 Fission

[19] Note that the fusion occurs simultaneously with the fission.

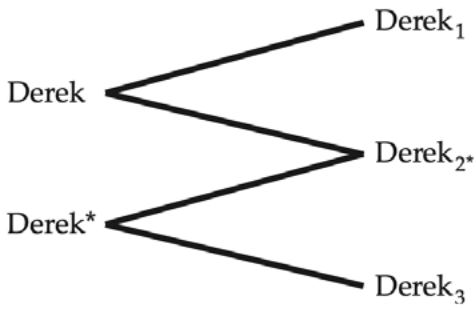


Fig. 1.2 Double-fission plus fusion

Consider the figure 1.2. We have:

(i) at t1: Derek ≠ Derek*
(ii) at t1: Derek = Derek$_{2^*}$
(iii) at t1: Derek$_{2^*}$ = Derek*

But, given (T_t), we also have:

(iv) at t1: Derek = Derek*,

which contradicts (i)[20].

[20] One way to avoid this critique is to reject the possibility that fusion and fission occur simultaneously. In this case, (OI) would not have a transitivity problem as it does not allow cases like the one described in Figure 1.2. Why should an occasionalist accept simple fusion and simple fission but not a combination of them? Once she accepts the formers, she seems, in a way, bound to accept the latter. If the thought experiment pictured in Figure 1.1 is acceptable, then the occasionalist countenances the possibility of fusion and fission. Maybe because she thinks they are conceivable (and then possible) or because she has no problem agreeing with using thought experiments that violate physical possibility. In both cases, the occasionalist should also accept the experiments involving fission and fusion: it is conceivable as well as the fissions or the fusions alone, and it violates physical possibility, too.

Langford and Ramachandran (2013) have argued in favor of a version of occasionalism immune to the transitivity argument. Their "creative view" states that fissions involve objects really dividing, namely the process creates objects which could not otherwise exist. The creative view allows to block the transitivity argument in so far as (ii) and (iii) are false. While avoiding the transitivity problem, Langford and Ramachandran's solution brings along a well-discussed issue: the intrinsicality of identity. What happens to Derek and Derek*? Is the fission comparable to death? Consider this case. Derek and Derek* enter the Duplicator. Unfortunately, it does not work properly. In fact, at the end of the process, only two people come out from the machine. Call them $Derek_n$ and $Derek_m$. $Derek_n$ is sufficiently similar to Derek to claim identity: he has not only the same body Derek had, but also all his psychological features. Equally, Derekm is sufficiently similar to Derek* to claim identity. Derek = $Derek_n$ and Derek* = $Derek_m$. What is the difference between this case and those described in Figures 1.1 and 1.2? In the previous cases, there is more than one person equally similar to Derek and Derek* to claim identity. However, it is unacceptable that the identity between Derek and $Derek_1$ depends on some other thing, like $Derek_2$. This is because, as I recall in section 1.3, identity is an intrinsic relation, namely it can depend only on the things involved in the relation. Otherwise, identity could be very different from the relation we are familiar with.

1.4.3 Against GoI: Contingent Identity

Recall the wax museum example. Consider the statue of Michael Jackson and the lump of wax from which it is composed and call them STATUE and LUMP. Given that the statue and the wax coincide spatiotemporally, some-

one might be tempted to say they are identical. However, even if we come to this conclusion, we might also admit that the statue and the wax could not have been one and the same thing. Imagine a world in which both STUTUE and LUMP exist, but STATUE is composed of a different lump of wax, and the LUMP is shaped in the form of a giant candle; or a world in which STATUE is destroyed but the lump of wax that formed it, namely LUMP, still exists. Alan Gibbard (1975) proposes this scenario to support the idea that identity is contingent, *i.e.*, relative to a world. In this case, the identity between STATUE and LUMP is valid in the actual world but fails in the ones described above.

(CI) $\Diamond(\exists x)(\exists y)(x = y \wedge \Diamond(x \neq y)$

Gibbard's position opposes the famous argument for the necessity of identity by Saul Kripke (1971). According to Kripke, if two things are identical, they are necessarily so. If STATUE and LUMP are identical, then they are identical in every possible world. The argument is the following.

(P1) $(\forall x)(\forall y)(x = y \longrightarrow (Px \longrightarrow Py))$,

(P2) $(\forall x)\Box x = x$.

(P1) is Leibniz's Indiscernibility of identical. (P2) is the placid truism – at least according to Kripke – that everything is necessarily identical to itself. Given (P1),

(1) $(\forall x)(\forall y)\ \ (x = y) \longrightarrow (\Box(x = x) \longrightarrow \Box(x = y))$,

where P in (P1) is substituted by the property "being necessarily identical to x". But if it is so, for (P2) and (1), it follows that

(2) $(\forall x)(\forall y)\ \ (x = y) \longrightarrow \Box(x = y)$.

Although this seems a persuasive argument, it is not a definitive rejection of contingentism. Or, at least, it would let advocates of contingent identity answer Kripke's proof. Following Noonan (1991), they could object to the passage from (P1) to (1) by arguing that modal predicates are "Abelardian", i.e., they can express different properties when combined with different terms[21]. Or they can endorse the above-presented Geach's position, according to which identity must always be relative to a sortal[22]. Finally, they can appeal to Gallois' idea that temporally quasi-rigid terms exist, given that Kripke's idea regards rigid designators.

I have already answered Gallois' quasi-rigid designators and Geach's relative identity thesis above. But what about Abelardian predicates? Even if, for the sake of discussion, Noonan has hit the mark – for a criticism, see Keefe (1995) – there is a further objection to contingent identity, namely a modal version of Bader's argument against the transitivity of occasional identity. Bader iterates the same dialectics also to (CI).

[21] «There are non-controversial of Abelardian examples predicates in present-day philosophical discussions. One such is Quine's predicate "was so-called because of his size". Clearly, this predicate is Abelardian: it stands for the property being called "Giorgione" because his size when attached to the name "Giorgione" and the property being called "Barbarelli" because of his size when attached to the name "Barbarelli"» (Noonan, 1991, 189).

[22] See Schwarz (2013).

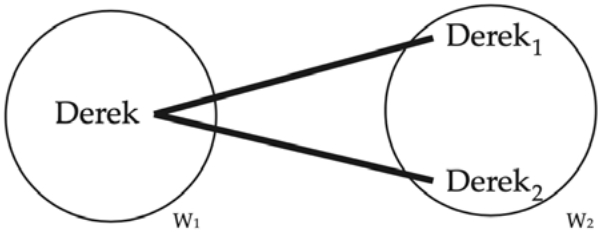


Fig. 1.3 Fission in different worlds.

Figure 1.3 describes a modal fission, *i.e.*, a case in which a thing in a world W_1 is trans-worldy identical to two distinct things in a different world, W_2. As in the occasional identity case, contingentists should appeal to a different version of transitivity, namely a world-indexed transitivity:

(T_w) $(\forall x)(\forall y)(\forall W)$ $((at\ W{:}x{=}y \wedge at\ W{:}y{=}z) \longrightarrow at\ W{:}x{=}z)$.

Nevertheless, this adjustment is insufficient to save contingent identity from the transitivity problem.

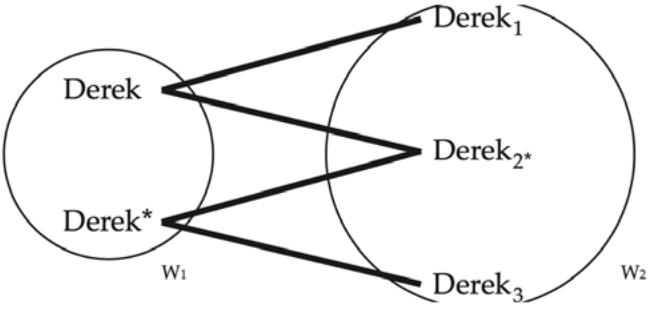


Figure 1.4 Double-fission plus fusion in different worlds.

Figure 1.4 shows that, if we consider a trans-word fission plus fusion, contingent identity fails to be transitive[23].

1.5 Diachronic identity and persistence

So far, I have outlined a purposely neutral metaphysical view. In my analysis of identity, I have not taken a stand towards the metaphysical worries that crowd persistence. In fact, arguing for the generality of identity is not bound to a particular worldview. However, this neutrality cannot last for long. In fact, on the one hand, GoI can be endorsed regardless of the metaphysics one supports; on the other hand, the principle I introduce in this section, namely the generality of diachronic identity, leads to confronting the metaphysical issues concerning persistence. For this reason, I will introduce and discuss the classic metaphysical views, *i.e.*, endurantism, perdurantism, and exdurantism.

In section 1.5.3, I will provide some classic arguments against endurantism. My intent here is not to defend nor to criticize them tout court. Instead, my analysis will be limited to enlightening a fact: endurantism is not compatible with the principle of the generality of diachronic identity. As a consequence, if we want to accept the principle, we should advocate a different metaphysics.

[23] The only way for a contingentist to save in part her thesis is to restrict once more transitivity relation also to the different sortal predicates:

$(T_{w,\ qua})\ \ (\forall x)(\forall y)(\forall W)\ \ ((at\ \ W{:}x_{qua\ F}{=}y_{qua\ G})\ \wedge\ at\ \ W{:}y_{qua\ G}{=}z_{qua\ H})\ \rightarrow$
$at\ W{:}x_{qua\ F}{=}\ z_{qua\ H})$.

This move works for the STATUE and LUMP cases but fails in the fission case and in all the other ones where there is only one sortal.

Following this line of reasoning, perdurantism, and exdurantism remain on the scene. As I will consider in the next chapter, while prima facie the differences between these two theories appear not to be significant28, they become substantial at a second and closer look. I will spend the second chapter supporting a radical version of exdurantism. This is because I note that perdurantism cannot provide a non-circular account of the relation between temporal parts. In doing so, I will support the idea that, given the impossibility of giving such an account, an exdurantist metaphysics without aggregates of temporal parts is more advisable.

1.5.1 The Generality of Diachronic Identity

As a general understanding, diachronic identity is a kind of identity. As opposed to synchronic, diachronic identity considers identity over time and change. If we accept the generality of identity, it is plausible to assert that identity over time is general too, as so far as there is just one concept of identity, *i.e.*, the formal one I described in §1.3.1. When we investigate the diachronic identity of Theseus' Ship, we ask whether Ship *1* (the ship with one plank replaced) and Ship *2* (the one with two planks replaced) are the one and the same object, namely Theseus' Ship. The process differs from the one put forward by the question: is Donald Trump the 47th President of the United States? Even if we concede that diachronic identity statements like the one about the ship of Theseus are formally different from the synchronic ones, ultimately, the difference does not concern the concept of identity. In both cases, we are asking whether there is a single object, though qualitatively different in the cases of diachronic identity. According to intuition, we are

allowed to expand the generality of identity also to diachronic identity:

(GoDI) Identity through time is a general relation that equally applies to different ontological domains.

Imagine identity as a set and diachronic identity as one of its subsets. If identity is general, given this picture, it is reasonable to admit that the diachronic identity should be general, too.

In the previous sections, I have argued in favor of the generality of identity by showing that every case of identity statements has the same form, *i.e.*,

(1) a = b.

If we substitute *a* and *b* with events, groups, or individuals, the "=" always means the same thing. In this respect, the result is the same if we add time to the equation. In fact, in diachronic identity statements, we have something of the form:

(2) a at t_1 = b at t_2.

Consider the following diachronic identity statements.

(i) Knicks vs Heat at 10' of the first quarter = Knicks vs Heat at 3' of the third quarter

(ii) 2001's Sugababes = 2009's Sugababes

(iii) DiCaprio in the morning = DiCaprio in the evening.

No matter what kind of entity we are considering, it is reasonable to claim that (i), (ii), and (iii) are all instances of (2).

1.5.2 Endurantism, perdurantism, exdurantism

The generality of identity puts forward more than one metaphysical issue. Saying that identity through time should be considered the same relation throughout different ontological domains, namely events, groups, and individuals, is not a neutral statement. The cases of persistence I have presented in the first section enlighten the different ontological categories and show different aspects of their persistence (how an event can change, to what extent a group can lose and gain components even though remaining the same, or how the one and the same entities can have different properties). On the other hand, the four puzzles provide a challenge for metaphysicians. How do we treat these metaphysical riddles? Of course, they question our commonsensical thoughts about persistence, and there are ways to dodge the problems they create. In the last fifty years, philosophers have tried to solve the puzzles by revising our placid intuitions or by making formal adjustments to the puzzles themselves. In each case, the question to start with is: "What are our metaphysical options?"

The debate over persistence through time classically consists of two views: endurantism and perdurantism. Endurantists conceptualize a persisting object as a non-temporally extended entity, fundamentally whole and complete at each moment of its existence. In contrast, perdurantists hold that entities are temporally extended with a different temporal part at each different instant of their existence. A third alternative emerged at the beginning of the twentieth century, namely exdurantism (or stage view). Exdurantists share with perdurantists the idea that entities are constituted by both spatial and temporal parts, yet posit that when referring

to ordinary objects, we talk about instantaneous temporal stages of four-dimensional entities.

An early stage of the debate is summarized by Lewis (1986, 202):

> «Let us say that something persists iff, somehow or other, it exists at various times; this is a neutral word. Something perdures iff it persists by having different temporal parts, or stages, at different times. Though no one part of it is wholly present at more than one time; whereas it endures iff it persists by being wholly present at more than one time».

This characterization of the endurantism and perdurantism debate has become classic. We can extrapolate two precise definitions from Lewis' analysis:

(i) Endurantism: Entities persist through time by being wholly present at each instant of their existence[24];
(ii) Perdurantism: Entities are four-dimensional fusions of temporal parts[25].

Furthermore, in line with this, we can also formulate the definition of the exdurantist position:

(iii) Exdurantism: Entities are instantaneous stages that do not ultimately persist[26].

[24] Baker (2000); Burke (1992, 1994); Chisholm (1976); Fine (2008/2006), Gallois (1998); Geach (1962); Haslanger (1989, 1994); Johnston (1992); Lombard (1994, 1995); Lowe (1987, 1989a, 1998); Mellor (1985); Merricks (1999, 2001); Rea (1997, 1998); Shoemaker (2015); Simons (1987); Thomson (1983); Van Inwagen (1987, 1990); Wiggins (1967); Zimmerman (1996).
[25] Armstrong (1980); Broad (1923); Carnap (1928); Goodman (1951); Heller (1990); Le Poidevin (2000); Lewis (1983, 1986); Lotze (1884); McTaggart (1927); Quine (1950, 1960); Russell (1927); Smart (1972); Whitehead (1920).
[26] Hawley (2001); Sider (1996, 1997, 2001a); Varzi (2003a).

Ultimately, the dispute is between those who believe in the existence of temporal parts (usually called four-dimensionalists) and those who do not (three-dimensionalists). The concept of entities having temporal parts is frequently illustrated through an analogy. As objects extend through space by having spatial parts, and everything we encounter consists of parts that occupy spatial regions, certain philosophers contend that entities extending through space and time must possess temporal parts (or stages).

Four-dimensionalism explains in this way how all entities persist through time. This perspective views entities as "spacetime worms" composed of temporal stages. A person, a ship, or a skyscraper can thus be understood as the sum of all its temporal parts, extending through both space and time. Just as persons occupy space through different spatial parts (*e.g.*, head, feet, nose), they occupy time through temporal parts (*e.g.*, me-now, me-yesterday).

The relationship between temporal parts of a single aggregate at different times is explained through counterparthood. As Lewis (1986: 232, fn.22) notes, counterpart relation, based on qualitative similarity, differs formally from identity as it is not transitive, symmetric, or functional[27]. One object can have multiple counterparts, and different objects might share a counterpart. Stage theorists like Sider (2001a) and Hawley (2001) apply this theory to time, arguing that entities persist through time via temporal parts connected through counterpart relations. According to the exdurantist approach, the logical forms of many temporal predications involve a counterpart relation. Sentences such as "Liz was a dentist before her retirement" are interpreted as "at t_1 there is a person-stage

[27] See Hall *et al.* (2024).

x such that *x* is a dentist and *x* is a temporal counterpart of *y*, where at t_2 *y* is a person-stage that is retired".

Out of the philosophy (and physics) departments, it is almost universally accepted that everything persists in a three-dimensional way. In this light, when I say that I am the same person I was ten years ago, I mean that there was a thing, me, ten years ago, which is the same thing I see in the mirror right now. Persons move along the three spatial dimensions and persist through time, and so do trees, cars, clouds, and so on. This is what wholly present means.

Even if our daily practice suggests otherwise, several philosophers do believe in the existence of temporal parts. There are various reasons for that. The classic lance that perdurantists and exdurantists use against endurantists is the so-called "problem of change":

> «Ordinary things, for instance we ourselves, undeniably persist through time. As we persist, we change. And not just in extrinsic ways, as when a child was born elsewhere and I became an uncle. We also change in our own intrinsic character, in the way we ourselves are, apart from our relationships to anything else. When I sit I'm bent, when I stand I'm straight. When I change my shape, that isn't a matter of my changing relationship to other things, or my relationship to other changing things. I do the changing, all by myself. Or so it seems. What happens must be possible. But how? Nothing can have the two incompatible shapes, bent and straight. How does having them at different times help?» (Lewis 1988: 65).

Friends of temporal parts solve the problem of change by saying that the one and the same thing is composed of different temporal parts, each of which has different properties. Just as spatial parts can display different properties, temporal parts can do it too. Much like it is not contradictory for my eyes to be blue while my hands are

not, it is not puzzling that I can exhibit different, even contradictory properties, such as being sitting and being standing, as these states belong to different temporal parts of mine.

By all means, this is not enough. Perdurantism, given his counterintuitive nature, has many detractors. Even if a four-dimensional metaphysics seems to better comply with the world described by physicist, it is considered an extremely absurd attitude[28].

Unlike endurantism, which depicts the commonsensical view, according to perdurantism, entities «are a lot like their stories. Just as my story has a part of my childhood, so I have a part consisting just of my childhood. Just as my story has a part describing just this instant, so I have a part that is me-at-this-very-instant»[29]. On the other hand, exdurantism can be approximated to the motion picture technique. In fact, in the same way as the dynamic image is an optical illusion created by a series of still images, the persistence of entities is only fictional. Nothing persists – in the Lewisian sense. A succession of numerical different instantaneous stages gives us the impression of a continuant entity.

In this section, I have outlined the classic debate about persistence by introducing definitions for endurantism, perdurantism, and exdurantism. While my exposition primarily focuses on these three principal theoretical positions, it is worth noting that there is a vast debate concerning non-mainstream views[30]. In the next section and in the second chapter, I will discuss arguments

[28] Cf. (Lowe (1987); Rea (1998); Thomson (1983); Van Inwagen (1990).
[29] Sider (2001b): 1.
[30] See, among others, Johnston (1987), Parsons (2000), Miller (2009), Daniels (2019), Costa (2017), and Giberman (2019). Moreover, the theory of location has shed new light on the debate. See Gilmore (2014, 2008); Gilmore *et al.* (2024); Parsons (2007).

against endurantism and perdurantism and provide reasons to endorse exdurantism as the only thesis able to support GoDI and as the best option in the metaphysics of persistence.

1.5.3 No hope for endurantism

Endurantism is typically characterized as the view that entities persist through time by being fully present at different times. The philosophical debate on endurantism has generated complex critiques, counterarguments, and sophisticated responses. Scholars have systematically challenged and defended the theoretical framework, producing a rich and dynamic discourse. In the first part of this section, I will present six of the most persuasive problems I think affect the theory. I am aware that, as Sider (2001a) outlines, there is no unique knocked-out argument. The most powerful argument in favor of endurantism lies in its adequacy to common sense. However, the perplexities arising from these critics may lead to reconsider this advantage. In addition, I will put forward a further perplexity, namely the inadequacy of endurantism towards the unified treatment of the phenomena of persistence suggested by the generality of diachronic identity.

There is a prodigious amount of literature about objections to endurantism. Let us start with David Lewis's (1983, Postscript B to Survival and Identity) seven-steps argument in favor of the existence of temporal parts:

> First: Consider a person. It is possible that it is divided into person-stages and that, therefore, person-stages exist. We can imagine that they appear out of thin air, then vanish again, or else. But it is a reasonable thought.
>
> Second: It is possible that two person-stages

might exist in succession, one right after the other but without overlap. Further, the qualities and location of the second at its appearance might exactly coincide with those of the first at its disappearance. If it is possible that X happens intrinsically in a spatiotemporal region, and if it is likewise possible that Y happens in a region, then it is also possible that both X and Y happen in two distinct but adjacent regions. There are no necessary incompatibilities between distinct existences. Anything can follow anything.

Third: Furthermore, it is possible that there might be a world of stages that is exactly like our own world in its point-by-point distribution of intrinsic local qualities over space and time.

Fourth: This world of stages might also be exactly like our own in its causal relations between local matters of particular facts, for nothing but the distribution of local qualities constrains the pattern of causal relations.

Fifth: Then, such a world of stages would be exactly like our own simpliciter. There are no features of our world except those that supervene on the distribution of local qualities and their causal relations.

Sixth: Then, our own world is a world of stages. In particular, person-stages exist.

Seventh: But persons exist too, and persons (in most cases) are not person-stages. They last too long. Yet, persons and person-stages, like tables and table-legs, do not occupy spatiotemporal regions twice over. That can only be because they are not distinct. They are part-identical; in other words, the person-stages are parts of the persons.

So, if temporal parts exist, a four-dimensional

> worldview is more reasonable than a three-dimensional one.

Sider (2001a, ch. 4) strongly defends perdurantism by addressing several critiques of the endurantist position. It is worth mentioning three of them. The first considers that endurantist's claim that entities are wholly present is either trivial or false. Trivial in the sense that all the parts an object has at a certain time are present at that time. False because, usually, all the parts that an object ever had or will have are not present at any given time. In fact, if I were a three-dimensional object wholly present at each time of my existence, I should have all the parts I had and all the parts I will have right now. However, this is clearly false because now I am composed of all and only my current parts.

The second is a common objection based on the analogy between time and space. All the physical objects we have experienced are located and move in both time and space. Moreover, there is a common topological and metrical structure between any given spatial dimension and the temporal one[31]. Besides, this is what physics teaches us: time is no more special than space. And if so, why should we let time apart in our metaphysics of persisting objects?

The third Sider's objection I consider is his reformulation of a powerful argument, namely the one from vagueness[32]. Consider the question: "Under what conditions do objects come into and go out of existence?". Perdurantists, granted the existence of temporal parts and the principle of unrestricted composition, answer that it al-

[31] See Schlesinger (1980) for an exhaustive discussion of the analysis .
[32] The debate has evolved significantly from Sider (2001a). See, among the other, Sider (2003; 2004) Balashov (2005), Nolan (2006), Miller (2005), Varzi (2005), Magidor (2015) and Eagle (2016).

ways occurs. Endurantists, on the other hand, say that it happens only under certain conditions (for persons, trees, chairs, buildings, and so on) and that these things go out of existence when they cease to be arranged in an appropriate way (when persons die, trees are cut, chairs are broke, buildings are destroyed, and so on). Sider shows that this way of thinking – the endurantist one – is subject to countenance vagueness in the world by way of ontic indeterminacy. The only way to avoid such an indeterminacy would be to accept the perdurantist's claim that any filled region of spacetime is the total career of some objects (Sider, 2001a: 120-139).

Another objection to endurantism is addressed by Achille Varzi (2003a, 394). According to him, endurantism is committed to essentialism. We are confronted with a critical dilemma: either we must embrace essentialism or, alternatively, we are compelled to abandon the endurantist framework. Varzi suggests that the only way an endurantist can explain the fact that an entity x can survive a change with respect to a certain property, P_1, but not with respect to a different property P_2, is by claiming the effect that P_2, unlike P_1, is an essential property of x.

The above-mentioned critiques are significant insofar as they highlight that common sense metaphysics is not as firm as it appears. One of the most powerful arguments for endurantists is that their worldview is "everyone's world-view", from children to rocket scientists. This is the view according to which we behave on a daily basis. For this reason, even if we encounter problems in dealing with puzzle cases of identity, we should adapt to them. But the question goes deeper: in the Philosophy Room, should we rely on a generally accepted theory, or should we try to understand the world even at the cost of

revising our commonsensical beliefs? I would favor the second.

Though compelling, the critiques of endurantism I have outlined do not represent a definitive resolution to the ongoing philosophical debate. Scholars have developed several counterarguments that complicate a straightforward dismissal of the endurantist position. In the context of this study, I aim to introduce an additional line of critique that may further problematize the endurantist approach.

I argue that endurantism fails to provide a satisfactory solution for proponents of GoDI—the thesis positing diachronic identity as a general relation that equally applies across diverse ontological domains. However, according to endurantism, diachronic identity does not behave that way. Endurantists fail to provide a unified theoretical framework for diachronic identity, as the classic three-dimensional approach introduces a fundamental ontological distinction between events and other entities. In fact, endurantism states that individuals are wholly present at any time they exist. For many endurantists, the very notion of temporal part is unclear or unacceptable when dealing with individuals[33]. This means individuals are considered continuants, i.e., entities that do not persist as being composed of temporal parts. While, usually, endurantists grant the events have temporal parts[34].

Roughly speaking, identity through time of events would consist of a relation between temporal parts. Take, for example, the basketball game. It persists through time having temporal parts, and the relation between temporal parts is what matters for its diachronic identity. On the other hand, Leonardo DiCaprio's persistence is

[33] See Lowe (1987); Thomson (1983); Van Inwagen (1987, 1990).
[34] Hawley (2024).

grounded on his three-dimensional character, given that he is a continuant[35]. This ontological difference leads to deny GoDI.

From a formal perspective, the relations between temporal parts and continuants exhibit fundamentally distinct characteristics. As previously noted, the relation among temporal parts is not an identity relation but rather a counterpart relation. In contrast, for continuants, an identity relation holds between the same entity at different times. These ontological forms and formal structures are inherently different. Consequently, no general relation can coherently apply across these disparate ontological domains, thereby undermining endurantism's ability to maintain the generality of diachronic identity.

My argument is conditional. It applies only if one accepts the generality of diachronic identity as described above. Otherwise, the debate remains open. However, if one does accept this premise, I believe there is little room for discussion: one should abandon endurantism.

[35] I will argue in detail this argument in section 2.1.2.

2. From Identity to Things

No one esteems me,
no one dreams me.

People put everything down on me,
design figures on me that they see,
that I never see.

But what if I were to open up?

Plane

In the first chapter, I argued for the thesis that identity is a general matter. Despite maintaining the generality of identity, which does not require any commitment to a particular metaphysical view about persistence through time, the principle of the generality of diachronic identity has metaphysical implications. If identity through time is general, then it is reasonable to maintain that it must equally apply to every ontological domain. I have argued that endurantism is incompatible with the generality of diachronic identity in so far as it is not able to provide such a unified treatment.

The link between the generality of identity and the generality of diachronic identity constitutes the basis of what I call "The Simple View". A simple viewer accepts that identity and identity through time are general relations. Both perdurantism and exdurantism can provide

the unified treatment GoDI requires. In the first part of the chapter, I will discuss two arguments the opponents of the Simple View (the "Complex Viewers") employ to criticize the transition from GoI to GoDI.

In the remainder of the chapter, I will support my claim that the exdurantist position is a better option than perdurantism. I aim to show that perdurantism cannot provide a non-circular and informative definition of the relation between temporal parts. As a consequence of this argument, in the last part of the chapter, I argue in favor of a radical form of exdurantism, namely a four-dimensional metaphysics where no temporal composition occurs and no four-dimensional worm exists.

2.1 Ontological complexity

In the first chapter, I have answered the critiques of GoI. In this section, I will present and reply to two critiques of GoDI. Call "The Complex View" the perspective according to which the ontological difference between events, groups, and individuals leads to a metaphysical one. The complex viewers may or may not accept the generality of identity. Of course, they can deny that diachronic identity is a kind of identity[1].What they deny is that diachronic identity is general, namely that every phenomenon of persistence through time should be treated univocally.

[1] It can be argued, for example, that we are led to identify diachronic identity as a kind of identity only because we call it diachronic identity. From the fact that we call Pluto a "dwarf planet", we cannot infer that it is a planet. As a matter of fact, Pluto is not a planet. This line of reasoning is perfectly coherent: even if we are used to calling something *x*, we are not granted that it is *x*.

I believe there are two ways to deny GoDI. The first approach, typically embraced by endurantists, is based on the very notion of temporal parts. Endurantists reject the idea that entities are composed of temporal parts. In this sense, as argued in the previous chapter, a three-dimensional worldview precludes the ontological uniformity essential for sustaining GoDI. Conversely, the relationship between GoDI and endurantism is bidirectional. Not only does accepting GoDI prevent adopting endurantism, but the inverse is equally true. We can reject GoDI based on its incompatibility with endurantism, just as I previously argued against endurantism by highlighting its incompatibility with GoDI.

The second is a specific kind of perdurantism that I call "naturalistic perdurantism". A naturalistic perdurantist maintains that some aggregates of temporal parts are natural (in a sense, I explore in section 2.2.2) and others are not. On this basis, she could argue that the persistence of natural aggregates is based on some natural facts, while the persistence of the other is just a matter of conventions.

2.1.1 The Simple View

What does GoDI imply? Take *The Game Case*, *The Band Case*, and *The Morning Star*. In an event like a basketball game, the commentators are discussing whether the game has changed. If we consider a group of people, a band, and we face the gradual replacement of its members, we wonder whether this change makes the band a different thing. Finally, whether Leonardo DiCaprio is the same person during the mornings and the evenings is true according to our concept of person, *i.e.*, to what extent a person can change while remaining the same.

Diachronic identity is the same relation to events, groups, and individuals. By all means, the reason why an event is the same at different times could diverge from groups or individuals. I am not considering criteria of identity here; the generality of diachronic identity is a wider concept[2]. The generality of diachronic identity does not imply that there is no ontological difference among events, groups, and individuals. One can also support more fine-grained ontology without discharging GoDI. For example, one can argue in favor of sortals and still think that identity through time is the same relation for different sortals. This is because, again, GoDI does not imply a further generality about criteria of identity – which are usually considered to set ontological differences among things[3].

Moreover, the fact that diachronic identity is general does not imply that we can investigate different metaphysical aspects of events, groups, and individuals either. In groups, we can deepen the questions about the relation between parts and whole. We can look for a criterion of personal identity for The Morning Star, or we can analyze the relation between events and their participants, and so on.

2.1.2 The enemies of temporal parts

Every basketball game is characteristically divided into four quarters, like every soccer game is divided into two halves; the life cycle of a plant is divided into germination, flowering, fruits' maturation, and senescence. Similarly, groups and individuals are divided into parts.

[2] The generality of diachronic identity does not depend on criteria of identity. For further reading on criteria of identity, see Lowe (1997, 1989b); Williamson (1990); Dummett (1981).
[3] Cf. Loux (2006, ch. 8).

Sugababes can be divided according to their components: we can take the band's components apart from one another, divide them into sub-groups, etc. Furthermore, a person has parts too. Your hand is a part of your body, and so is your head. The leaves are part of the branches, which are part of the tree. A consistent number of trees forms a forest as a plurality of persons may form an army.

Everything we have experience with has parts. However, there is an important distinction to draw. When we say "the game is composed of four quarters" and "the tree is composed of roots, trunk, branches, and leaves," we are talking about two different kinds of parts, namely temporal parts and spatial parts. Temporal parts extend in time, while spatial parts extend in space. The concept of entities having temporal parts is frequently illustrated through an analogy. As persons extend through space by having spatial parts, and everything we encounter consists of parts that occupy spatial regions, certain philosophers contend that entities extending through space and time must possess temporal parts (or stages). Just as spatial parts can display different properties, temporal parts can do it too. Much like it is not contradictory for my eyes to be blue while my hands are not, it is not puzzling that I can exhibit different, even contradictory properties, such as being sitting and being standing, as these states belong to different temporal parts.

Four-dimensionalism explains in this way how all entities persist through time. This perspective views entities as "spacetime worms" composed of temporal stages. Thus, A person can be understood as the sum of all her temporal parts, extending through both space and time. Just as persons occupy space through different spatial parts (e.g., head, feet, nose), they occupy time through temporal parts (e.g., me-now, me-yesterday).

Commonly, the fact that events are composed of temporal parts is nearly undisputed. However, in the last fifty years, this qualification has been questioned. A large number of philosophers opt for extending the temporal parts also to individuals and groups.

> «Persistence through time is like extension through space. A road has spatial parts in the subregions of the region of space it occupies; likewise, an object that exists in time has temporal parts in the various subregions of the total region of time it occupies.» Sider (1997, 197).

The analogy between time and space is helpful to understand what a temporal part of an individual is. Many authors illustrate the topic this way[4]. With few exceptions, the idea that individuals and groups have temporal parts is strenuously criticized by the advocates of the opposite metaphysical view, three-dimensionalism. According to three-dimensionalists, only events have temporal parts[5], while everything else persists by being *wholly present* at each time of its existence. For example, Wiggins (1980, 2001) maintains this ontological gap between events and the other entities by arguing that the former occupy periods of time while the latter persist through time. Another strong aversion to the four-dimensional conception of temporal parts comes from Van Inwagen (1981), who claims that the very notion of temporal part is unclear.

> «I simply do not understand what these things are supposed to be, and I do not think this is my fault. I think that no one understands what they are supposed to be, though of course plenty of philosophers think they do» (p. 133).

[4] Cf. Varzi (2003a); Hawley (2024; 2001); Sider (2001b).
[5] Pace Chisholm (1973) and a few others.

Let us follow this line of reasoning and assume that the critics of temporal parts are right for the sake of discussion. If so, events have temporal parts, and individuals and groups have only spatial parts. In conclusion, suppose that they endorse GoDI. Take the following instances of identity over time:

(*) Lakers-Knicks game at t_1 = Lakers-Knick game at t_2;
(**) Leonardo DiCaprio at t_1= Leonardo DiCaprio at t_2.

It seems that (*) and (**) are instances of the schema of diachronic I have introduced in the first chapter:

(2) a at t_1 = b at t_2.

However, from a closer look, if we support a thesis similar to Wiggins', they are not. Let us make some substitutions. In (*), take t_1 as the first quarter of the game and t_2 as the second. In (**), take t_1 to the morning and t_2 to the evening. Then we have:

(*^) Lakers-Knicks' first quarter of the game = Lakers-Knicks' second quarter of the game;
(**^) Leonardo DiCaprio in the morning = Leonardo DiCaprio in the evening.

But (*^) and (**^) instantiate two very different relations. In fact, while (**^) is an instance of (2), (*^) is not. Saying that the Lakers-Knicks first quarter is identical to the second one is false. If events have temporal parts, then diachronic identity statements like (*^) are not identity statements. A temporal part is strictly identical only to itself, exactly like a spatial part of my body, my left hand, is not numerically identical to another, my right foot. The two temporal parts of the game are distinct: they are two different moments of the same event.

For the relation among temporal parts, we have something of the form:

(3) a at t_1 is a temporal part, b is a temporal part at t_2: $a =_G b$.

where $=_G$ means: «to be part of the same portion of matter»[6]. (3) and (2) are different relations. Given that (*) and (*^) are equivalent, (*) is not an instance of (2). So, the position that events only have temporal parts is not appropriate for GoDI because identity through time applies in different ways in different ontological domains.

If we hold the first type of Complex View, we face two choices: stating that events do not have temporal parts or assuming GoDI is false. On the one hand, the first branch of this disjunction is too hard of a bullet to bite. How can we deny that events are composed of temporal parts? I do not see any plausible defense of such a thesis: events are not static entities. From a tridimensional perspective, this differentiates them from groups and individuals, as the previous quotations by Wiggins and van Inwagen suggest. On the other hand, stating that GoDI is false is not an easy path to follow. According to three-dimensionalists, diachronic identity is a genuine case of identity. So, why should they deny the passage from GoI to GoDI? Why, if identity is a general matter, identity through time is not?

2.2 Naturalistic Perdurantism

Take soccer teams, pop-rock bands, and nations. Persistence of such things has, at least in a narrow sense, a conventionalist character. Consider the Band Case. Call

[6] Sider (2001a, 225). We can read $=_G$ as a counterpart relation or, more generally, as "genidentity".

Sugababes1 the band formed by the original members in 1998: Siobhán Donaghy, Mutya Buena and Keisha Buchanan. Call Sugababes2 the band with Siobhán Donaghy replaced by Heidi Range. Call Sugababes3 the band with Siobhán Donaghy replaced by Heidi Range and Mutya Buena replaced by Amelle Berrabah. Call Sugababes4 the band with Siobhán Donaghy replaced by Heidi Range, Mutya Buena replaced by Amelle Berrabah, and Keisha Buchanan replaced by Jade Ewen. Call Sugababes5 the band formed again by the original members in 2011.

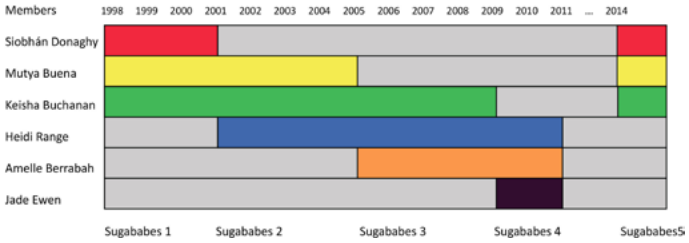


Figure 2.1: Sugababes over time

We can now ask ourselves the following question: in which way do the Sugababes persist? How can we identify Sugababes1 with Sugababes4 even if all the original band members have been replaced? One viable option is that the persistence of groups is a matter of conventionality, while the persistence of events and individuals is not. One could be tempted to say that, provided that groups are formed and persist by conventions, they are not a natural way to carve reality at its joints[7]. If to increase sales, the record company decided to create a new band with the four original members of Sugababes called Honeybabes, this would lead us to consider Honeybabes as different from Sugababes. The fact that Sugababes3 is iden-

[7] Sider (2011).

tical to Sugababes4 can be seen as arbitrary as the fact that Sugababes is distinct from Honeybabes. It would be sufficient that the record company, the band members or a third party decides if Sugababes is identical to Honeybabes, or if Sugababes_3 is identical to Sugababes4.

2.2.1 Restricted Conventionalism

Regardless of the decision we settle on, we can argue that this is a matter of conventions. This issue concerns not only bands but also a vast number of groups. Take, for instance, the sports teams. A team can change name and/or location (e.g., NBA team Oklahoma City Thunder was previously Seattle SuperSonics), can merge with another team (Italian soccer team Sampdoria is the merge of Sampierdarenese and Andrea Doria), gradually change all its players, undergo bankruptcy and still be considered the same team. Moreover, take one of the most important socio-economic entities: nations. To what extent can a nation change (e.g., borders, language, currency, legislature, constitution) while remaining the same? All these questions involve conventions, practically in the form of stipulations.

If the examples I have provided present this conventional aspect, it seems that most beings do not. While the persistence of Sugababes is a conventional fact, we are inclined to say that the existence and persistence of people, trees, microwaves, boiling water, and building constructions is not. This line of reasoning can lead to the second approach to reject the thesis that a unified treatment of all the phenomena of persistence is needed. Stating that some groups or some individuals (like artifacts) persist in a conventional way while other entities persist according to their natural joints is the second version of what I have called the Complex View. If conventions ap-

ply only to some entities, we cannot talk of the generality of persistence because there will not be a univocal way to treat all the phenomena of persistence.

If we discard endurantism for not being the best choice for a unified treatment of the phenomena of persistence, perdurantism, and exdurantism are left on the table. This is to say that we can keep supporting the generality thesis in a four-dimensional world. However, we cannot take the generality for granted, even in such a metaphysical picture. If a perdurantist is what I call a "naturalistic perdurantist", she will be able to reject the Simple View by adopting different ontological categories for different kinds of four-dimensional worms. In the next section, I will highlight some of the issues associated with such an approach.

2.2.2 Egalitarianism

According to perdurantism, there is nothing as a numerical same object existing at different times. Objects are aggregates of temporal parts as well as spatial parts, each existing at a time. But what is the relation between the temporal parts of a single aggregate? In the four-dimensional worldview, given the mereological principle of the unrestricted composition, for any plurality of temporal parts, there is a mereological aggregate of those temporal parts.

Perdurantists consider all the aggregates on the same metaphysical level, i.e., we can quantify and talk about all of them without differentiating. Despite this worm equality, someone might be tempted to say there is a difference between some worms and others. To paraphrase George Orwell's Snowball in Animal Farm, all worms are equal, but some worms are more equal than others. In particular, it might be argued that some worms are in some

sense natural, e.g., worms that instantiate natural sortals, or worms all of whose parts are homogeneous and nicely connected, and others that are not. This is a version of what Hirsch (1993) calls ontological inegalitarianism. Let us call it naturalistic perdurantism.

I argue that a perdurantist who accepts the unrestricted composition cannot set any significant metaphysical difference between worms. I do that by showing that this problem recalls the so-called Special Composition Question (SCQ), i.e., the question about under what circumstances some things compose a single object. If the SCQ distinguishes which aggregates exist and which do not, what I call the Special Nature Question (SNQ) distinguishes which aggregates are natural and which are not. Given this analogy, I suggest that the vagueness argument against the restricted composition can be applied, mutatis mutandis, to the idea that some aggregates are acceptable while others are not.

When a perdurantist accepts unrestricted composition, she adopts universal- ism. She has all the possible fusions in her ontology, given that universalism states that every possible fusion exists. According to her ontology, some fusions are the objects we are familiar with, e.g., persons, chairs, skyscrapers, and swimming trunks. Call this first kind of fusions, Na. Moreover, she has an even larger number of fusions that we can call freaky, Fa. Freaky fusions are the sums that are not part of the standard ontology (Korman, 2015). Among the Fa, we find Lewis' (1991, 7-8) trout-turkeys, Hirsch's (1992, 32) incars and outcars, Chisholm's (1973) fusion of temporal parts of his left foot and Grand Central Station, and so on.

Certainly, one can state there is no difference between Na and Fa. This position is compatible with the joint acceptance of universalism and perdurantism. But it

becomes problematic if one tries to justify the commonsensical intuition that, given that the Na are natural, they have a sort of ontological supremacy over the Fa.

What is (if any) the metaphysical difference between Na and Fa? One could answer that aggregates like Na are homogeneous, i.e., well-organized and well-connected. In this respect, one could say that a Na instantiates natural sortals by virtue of its homogeneity. "There is something in the temporal parts themselves that guides our categorization of the aggregates", and "All the temporal parts of Elizabeth II are related in a compatible way, such that the temporal part of a trout-turkey are not", she might say.

A further question is: what does "natural" mean? Put the definition of "natural" you favor. Broadly speaking, what I have in mind is "natural" as opposed to gerrymandered, arbitrary, conventional, wildly assorted. For example, one could think of a natural worm as one whose temporal parts are spatially continuous so that Chisholm's left foot and Grand Central Station would not be natural. Otherwise, one could think that a natural worm is one whose temporal parts are causally continuous. In this case, a trout-turkey would not be a natural worm.

The position originated from these answers to the two questions presented above (what is the difference between natural and freaky aggregates? What does natural mean?) is naturalistic perdurantism, i.e., the position according to which there is a metaphysical difference between worms based on some natural properties they instantiate. I argue that naturalistic perdurantism is a loose attempt to combine some pre-philosophical intuitions with the perdurantist account. Why should we have to posit that if something appears natural or intuitive, it has to play a substantial role in our ontology? This line of reasoning does not convince me. In this way, it looks like

we are just ontologysing a distinction we like by doggedly looking for a natural correspondence for our distinction in the world.

2.2.3 Special Composition Question and vagueness

I try to weaken naturalistic perdurantism by a comparison. I argue that the problem of telling the difference between the natural and the freaky worms recalls the problem of telling under what circumstances some things compose a single object, namely Van Inwagen's (1990, 31) special composition question:

> SCQ What would one have to do – what could one do – to get the x s to compose something?

The answers to the SCQ are of four kinds: (i) the nihilists argue the x s never compose an object; (ii) the universalists argue that the x s always compose an object; (iii) someone proposes an in-between solution - like Van Inwagen (1990) himself when he states that only "living things" exist; (iv) the brutalists argue that there is no true answer because it is just a "brute fact" that the relevant objects compose something.[8]

My idea is that naturalistic perdurantism is a way of putting forward again the SCQ in a universalist world. As perdurantism accepts unrestricted composition, it entails (ii). So, according to a perdurantist, every material object composes something. But once one supports universalism and wants to justify a difference between kinds of fusions, another question arises, i.e., the special nature question:

[8] Markosian (1998).

SNQ What would one have to do to get temporal parts to compose a natural worm?

If, in the SCQ, the problem is to separate the sums that exist from the ones that do not, in the SNQ, the problem is distinguishing between the Fas and Nas. The answers to the SNQ are of two kinds: (i*) regardless of how temporal parts are related, it is impossible to set any difference between fusions; (ii*) temporal parts have to be related in such a way that the fusions instantiate a natural sortal; (iii*) it is a brute fact that some fusions are natural and some others are not. Even if these answers slightly differ from the ones in the SCQ, we can see a similarity. While (i*) corresponds to (i) and (ii), given that we can read it as "no matter what, every fusion is natural" or "no matter what, no fusion is natural", (ii*) corresponds to (iii), and (iii*) to (iv).

How do we deal with this similarity? I propose that the vagueness argument against restricted composition [Lewis (1986); Sider (2001a)] can be applied, mutatis mutandis, to the SNQ. Here, I agree with Hawley's (2001, § 3.6) assessment of the idea that naturalness comes in degrees. In this respect, if the vagueness argument leads to accepting universalism, then its "naturalistic version" will lead to rejecting naturalistic perdurantism.

When bits of matter are arranged in certain ways, an object—say, a person—comes into existence, and that thing goes out of existence when the bits cease to be arranged appropriately. But what sorts of arrangements are suitable? If one arrangement is suitable, then a slightly different arrangement would also seem suitable. Iterate this procedure, and we conclude that objects always come into and go out of existence, no matter how bits of matter are arranged.

Consider a series of possible worlds W1… Wn. In W1, there is a person, Peter1, whose body consists of n molecules. In W2, there is something, Peter2, that is exactly like Peter1, except for one molecule of his body, which has been replaced by a molecule of a scrambled egg. The difference is negligible, so it is reasonable to suppose that Peter2 is a person, too. At least, it is reasonable to suppose that Peter2 exists: it is a legitimate mereological fusion if Peter1 is. More generally, for each k n, world Wk+1 contains something, Peterk+1, that is a perfect copy of Peterk, except for one molecule, which in Peterk+1 is a molecule of a scrambled egg. Thus, in Wn, there is something, Petern, that consists entirely of molecules of a scrambled egg. Never mind whether Petern is a person. Since there appears to be no cut-off value of k such that Peterk counts as a legitimate mereological fusion while Peterk+1 does not, this scenario yields a sorites that supports the argument from vagueness for mereological universalism.

Transposing Sider's version of it, we can consider a slightly different argument. If we move from aggregates of molecules to aggregates of temporal parts, we can construct the same dialectics.

When temporal parts are arranged in certain ways, an object — say, a person — is a Na; when the temporal parts are not well-organized and well-connected to each other, their fusion is a Fa. But when are temporal parts related in such a way? If two temporal parts are well-organized and well-connected, if we consider a slightly different temporal part, it seems to be well-connected and well-organized as well. Iterate this procedure, and we conclude that temporal parts are well-organized and well-connected to each other, no matter which temporal parts are connected.

Suppose that in world W1, there is a person, Carl1, who is an aggregate of m person stages, Carl11 Carl1m. According to a naturalistic perdurantist, Carl1 is a natural worm. Now, pick a j somewhere in the middle between 1 and m, let n be the number of molecules composing the body of Carl1j, and consider the series of possible worlds W1 Wn, which is defined as follows. In W2, there is a sequence of temporal stages Carl21… Carl2m such that Carl2i is a perfect duplicate of Carl1i for each i m except for Carl2j, which differs from Carl1j in that one of his molecules has been replaced by a molecule of a scrambled egg. Despite this difference, it is reasonable to suppose that Carl2j counts as a person stage if Carl1j does.

After all, the difference is negligible. Hence, it is reasonable to suppose that the fusion Carl21… Carl2m counts as a natural worm if Carl11… Carl1m does. If the naturalistic perdurantist allows this move, then she opens the door to an argument similar to the vagueness argument for mereological universalism. The move can be iterated so that each Wk+1 contains something, Carlk+1, whose temporal stages are exactly like those of Carlk except for Carlk+1j, which differs from Carlkj in that a new molecule has been replaced by a molecule of a scrambled egg. In particular, in Wn, we have Carlnj, which consists entirely of a scrambled egg and is not, therefore, a person stage. Thus, Carln is an aggregate composed of m-1 person stages and one scrambled egg stage. Yet, the naturalistic perdurantist is not in the position to pinpoint any cut-off value of k such that Carlk counts as a natural worm while Carlk+1 does not.

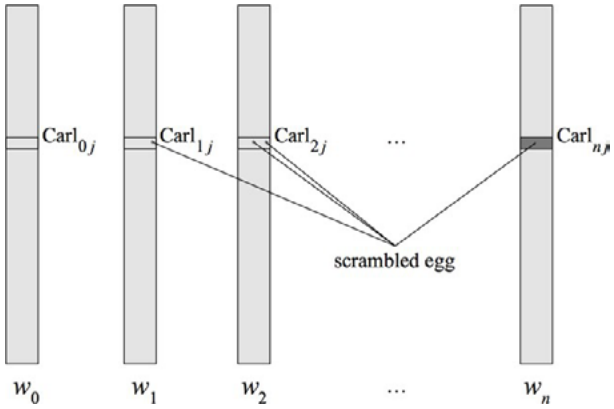


Figure 2.2: Scrambled egg.

2.2.4 All worms are equal

I argue that this argument is a reason to deny naturalistic perdurantism, given that it leads to the idea that it is impossible to tell the natural apart from the freaky worms. Moreover, it is also impossible to define what a natural worm is, given that we cannot define "natural" without coming across, once and again, the sorites originated from the vagueness argument. Distinguishing between natural and freaky fusions recalls distinguishing between which aggregates exist and which do not. Once we have bought universalism and consequently accepted all the possible fusions, how can we draw any ontological line between them (short of accepting brute facts)? In light of my argument, the simple answer is that we cannot.

2.3 A world of temporal parts

In the first part of the chapter, I have presented two possible options for an enemy of the Simple view, namely a critique of temporal parts and naturalist perdurantism. In the next sections, I will address a critique of classic perdurantism based on the circularity of the relation between temporal parts.

The acceptance of this concerns also exdurantist position. In fact, given that exdurantists usually accept fusions of temporal parts in their ontology, they have the same problem as perdurantists – even if fusions do not play a central role in their metaphysics. For this reason, in the last part of the chapter, I will illustrate a radical form of exdurantism, free of four-dimensional fusions of temporal parts.

2.3.1 Relation between temporal parts

Recall the Fission Case presented in §1.2.4. At the end of the experiment, we see that Derek_1 is identical to Derek, and Derek_2 is identical to Derek even if Derek_1 and Derek_2 are distinct. This thought experiment has generated a vast debate in many areas of philosophy. It puzzles our common intuitions about personal identity: we have a situation that usually allows us to claim identity between Derek, Derek_1, and Derek_2 but cannot actually support it without arguing against the transitivity of identity and the principle of the identity of indiscernibles. However, the amoebic division is also problematic from a more general metaphysical point of view. Depending on which metaphysics we use to explain (or solve) the puzzle, we examine other classical metaphysical issues, from persistence to spatiotemporal coincidence to the generality of identity.

One of the most interesting solutions to the fission case is offered by Derek Parfit (1971, 1984), with the so-called "identity doesn't matter view". In short, Parfit supports his thesis with the following argument.

(i) Identity has a certain formal character, such that it does not permit degrees and is a one-one relation.
(ii) A criterion of personal identity does not have the same formal character. The above fission example shows how this relation can be one-many or many-many.
(iii) We cannot consider that two relations with different formal characters go together, so we must give up identity, the relation posing the paradox.

What matters for Derek's survival is not whether $Derek_1$ or $Derek_2$ is identical to him, but whether Derek has a certain psychological relation with them, even if it does not coincide with identity. Personal identity is not dependent on identity. It would be the case that, to say, $Derek_1$ is the best candidate for the persistence of Derek even if $Derek_1$ is not the same person as Derek.

If correct, Parfit's solution would solve the perplexities arising from the puzzle concerning personal identity. However, from a metaphysical point of view, we need a strong justification to reject diachronic identity concerning persons. It is not a coincidence that "identity doesn't matter" has been discussed by David Lewis in a famous tit-for-tat between him (1983) and Parfit (1976). Lewis argues that his position can be assimilated to Parfit's[9]. Ac-

[9] Lewis is not the only one who believes that identity doesn't matter view can be endorsed in a four-dimensional framework. Merricks (1999, 2022) argues that it is committed to a four-dimensional metaphysics, along with all the psychological theories of personal identity.

cording to Lewis himself, the only difference between their positions is that: «Derek Parfit rejects my attempt to square his views (which are mine as well) with common sense» (Lewis, 1983: 73). Here, I am not interested in a historical reconstruction of this debate, nor in a perdurantist reading of Parfit's work. What I am interested in is Lewis' answer to this puzzle. Lewis is probably the most famous and influential perdurantist. He believes that objects are mereological fusions of temporal parts. His solution to the fission problem is to accept coincident entities. Two four-dimensional coincident objects are simply objects that share their temporal parts. There is not a real coincidence problem[10]. In the fission case, Derek_1 and Derek_2 share all their temporal parts until the division. They exist as coincident objects in that interval and as non-coincident after the fission. With this so-called multiple occupancy thesis, Lewis wants to save the commonsense platitude of identity by arguing that, indeed, identity does matter in so far as Derek_1 and Derek_2 existed before the division.

Lewis (1983, 58–59) considers two different relations between temporal parts: the R-relation and the I-relation.

(1) R-relation = df relation of mental continuity and connectedness among person-stages;
(2) I-relation = df relation that holds among several stages of a single continuant person.

(1) is a relation that can be accepted by a supporter of identity doesn't matter view. In fact, R-relation is mentioned—even without any reference to temporal parts—by Parfit (1971, 1984). On the other hand, (2)

Specifically, in Patrone (2017), I argue that Parfit's thesis is incompatible with endurantism and perdurantism, claiming that it can be defended only within exdurantism.

[10] Cf. Sider (2001a, 152-153).

is a relation about the aggregates. If (1) provides a loose connection, (2) strongly connects stages. Take a temporal part of Derek before the division, D_1, and a temporal part of Derek$_1$ the instant after the fission, $D^1{}_1$. D_1 and $D^1{}_1$ are surely R-related. But this is not sufficient to consider them as temporal parts of the same person. D_1 and $D^1{}_1$ are temporal parts of the same person if and only if they are I-related. It is not clear if the fact that two temporal parts are I-related implies that they are also R-related, but we can skip this concern. According to a perdurantist, D_1 and $D^1{}_1$ are R-related because they exemplify psychological continuity and connectedness. Moreover, they are I-related because they are temporal parts of a single object. Consider now Lewis' definition of what a single continuant person is:

(3) Person $=_{df}$ mereological aggregate of I-related person stages.

There is something fishy here. We need the definition of "single continuant person" for the definition of the I-relation. But if the definition of person is of the kind of (3), our definition of I-relation becomes:

(2*) I-relation $=_{df}$ relation between several stages of a single mereological aggregate of I-related person stages.

We cannot accept (2*). It is not only non-informative but also circular. Indeed, it is far from easy to define I-relation, so it provides a good criterion. Unfortunately, Lewis remains the only scholar who has attempted to define this relation systematically, while others either rely on his definition without critical examination or show little interest in developing the concept further[11].

[11] See Sattig (2008), Sider (2001, 194).

A suitable explanation for the circularity of the I-relation directly concerns the nature of perdurantist metaphysics. In fact, perdurantism accepts the principle of unrestricted composition[12], according to which, for any set of temporal parts, there is a mereological fusion of those temporal parts. Given this mereological principle, it is trivially true that two temporal parts belong to the same fusion since, for any temporal parts, there exists an object that is the fusion of them. Hence, it seems necessary to introduce a relation such that it picks up a mereological fusion according to specified conditions.

So, let us try to reformulate it avoiding the circularity. We can consider I-relation as a relation of causal dependence and spatiotemporal and qualitative continuity[13]:

(4) I-relation = df relation of causal dependence and spatiotemporal and qualitative continuity between temporal parts.

I-relation, as characterized in (4), is informative and non-circular. Unfortunately, it does not provide sufficient or necessary conditions for two temporal parts to be part of a definite fusion. Consider D_1, Derek's temporal part at t_1, where t_1 is the instant before a fatal heart attack, and D_2, Derek's corpse's temporal part at t_2, where t_2 is the instant right after Derek's death. Between D_1 and D_2, there is a causal dependence relation. Likewise, D_1 is causally dependent on D_0, Derek's temporal part at t_0, with $t_1 > t_0$. D_1 and D_2 are spatiotemporally and qualitatively continuous. In this respect, there is no better successor for D_1 than D_2. Nevertheless, D_1 and D_2 hardly belong to the same fusion "Derek", because we do not usually take corpses (or their temporal parts) to be persons (or part of

[12] See Sider (2001), Varzi (2024).
[13] Cf. Sattig (2008, 183).

them)[14]. In the same way, D_1 does not belong to the fusion that has D_2 as the first temporal part because we usually do not define corpses as having "living" temporal parts. This is certainly a problem that necessitates a revision to (4). However, it is unclear what kind of revision is needed, given that even if we ensure that the temporal parts have to instantiate the same sortal, it remains problematic[15].

Although perdurantism can avoid the first metaphysical worries I discussed about identity doesn't matter, the problem of accounting for the nature of the relation between stages of a particular aggregate remains.

2.4 "Defusing" the world

In the previous section, I have shown the difficulty of characterizing the relation among temporal parts in a non-circular way. This is a substantial shortcoming for a theory of persistence. Furthermore, this is not a trouble for Lewis' theory only. To my knowledge, there is no other suitable way to describe it. Sider (2001a, 190) says that the relation between temporal parts, called "genidentity", "unity relation", or "I-relation", can be «analyzed in some way (in the case of persons perhaps in terms of memory or bodily continuity) or taken as a primitive». My argument illustrates that I-relation cannot be analyzed in terms of a criterion of identity, nor can it be taken as primitive in so far as it is circular and non-informative.

What, then? My argument does not undermine the idea of a four-dimensional worldview. It only shows that perdurantism does not provide an adequate criterion for

[14] With notable exceptions. See Olson (1997) and Mackie (1999).
[15] See Varzi (2003a, b).

the relation between temporal parts. Although, according to exdurantism, the aggregates of stages do not play an important metaphysical role, so exdurantism can still work as a good metaphysics for the supporters of generality. In this part, I will discuss an option for exdurantists: given that the relation between stages is not satisfactorily characterized, what if exdurantism gets rid of it?

2.4.1 What are worms for?

As noted, many exdurantists take themselves to share a "common metaphysical picture" with the perdurantists (Hawley, 2001, 48). Some take their view to be a mere version of perdurantism (Sider, 2001, 218), one which, from the metaphysical point of view, is committed to instantaneous temporal parts, the stages, and that, from the semantic point of view, takes these stages – and not the fusions – to be the referents of the singular terms of our ordinary language[16]. It is worth noting that in a framework in which there are both fusions and stages but where the ordinary objects we usually speak about and quantify over are the stages, the fusions do not play any metaphysical purpose at all. In Varzi's words,

> The stage view is truly reductionist, in that all the work is done by the time-bound stages; their temporally extended aggregates, if such there be, add nothing. (2003, 407)

For exdurantists, fusions seem to be nothing over and above a logical consequence of their acceptance of an independent mereological view, mereological universalism, a.k.a. unrestricted composition, according to which for any substances there exists such a thing as the mereo-

[16] See (Hawley, 2001; Sider, 1996, 2001; Varzi, 2003). Heller (1990) is a notable example of an exdurantist that denies the semantic thesis, which is otherwise considered standard.

logical sum, or fusion of those substances (Sider, 2001, 7). Given mereological universalism, the existence of fusions is a trivial consequence of the existence of the stages.

However, mereological universalism has been put into question, not only by advocates of the commonsensical view that some sets of entities compose wholes and others do not, but also by recent defenses of the other radical option, mereological nihilism, according to which no composite object exists or, in other words, for no set of entities there is such a thing as their mereological sum (Rosen and Dorr, 2002; Sider, 2013; van Inwagen, 1987, 1990b).

It is also interesting to note that, *modulo* universalism, there indeed are no reasons for an exdurantist to accept worms in her ontology. One may think, for example, that (i) if time is gunky – hence if there are no instants of time – there may be worms and gunky temporal parts, but no stages – which are instantaneous (Hawley, 2001, 52). Similarly, one may think that (ii) with the worms, one could more easily make sense of propositions that seem to be about ourselves in the past and the future.

However, on closer inspection, these are not reasons for an exdurantist to accept worms in her ontology. Rather, since they require (i) to do without instantaneous stages or (ii) to identify ordinary objects with worms, they are rather reasons for an exdurantist to stop being an exdurantist and become a standard perdurantist instead.

2.4.2 All world's a stage (for real)

If, on the one hand, there seem to be no reasons, *modulo* universalism, for an exdurantist to accept worms in her ontology, on the other hand, there seem to be reasons to do away with such worms. First, there are concerns about ontological parsimony. Notice that the case

of worms is different – worse, actually – than other cases in which ontological parsimony has been invoked. Consider universals, for example. Universals are usually introduced to perform some noble metaphysical work, *e.g.*, to explain similarity relations.

Of course, there is always room for disagreement about the real necessity of universals to explain similarity, but at least friends of universals think that universals are there for a purpose; their existence has a meaning. Not so about the exdurantist's fusions, which are there for no purpose at all. If there is a case in which Occam's Razor should be used at all, it surely is this one. Moreover, exdurantism is typically introduced as the temporal analogue of modal counterpart theory: just as counterpart theory says that no entity exists at more than one world, so exdurantism says that no entity exists at more than one time. Similarly, just as counterpart theory identifies ordinary substances with world-bound entities, so exdurantism identifies ordinary objects with instantaneous stages[17]. Furthermore, just as counterpart theory does not introduce transmundane worms, one would expect exdurantism not to introduce transtemporal ones.

The interest of a "defused" version of exdurantism may also come from carefully considering the views with which it may be conjoined and the results that would come from this conjunction. For example, such an exdurantist could consider conjoining her view with mereological nihilism. As I will show in chapters three and four, by endorsing nihilism, the exdurantist would be able to offer a unified treatment to all phenomena of spatiotemporal extension. In this world, populated exclusively by atomic entities, everything would be world-bound,

[17] On the analogy between exdurantism and modal counterpart theory, see (Hawley, 2001; Sider, 1996; Varzi, 2003).

time-bound, and space-bound. All appearances of extension through space, time and possible worlds would then be explained away in the very same manner, *e.g.*, by appealing to a counterpart relation linking numerically different atomic entities (Varzi, 2003), by paraphrasing away our talk about extension in terms of pluralities of atoms and their arrangements (Sider, 2013), or, again, by appealing to fictionalist accounts of the semantics of our everyday terms referring to allegedly extended entities (Rosen and Dorr, 2002).

It would be quite simple for the exdurantist to get rid of worms. She basically has to define exdurantism as the view that no entity persists:

> (RADICAL EXDURANTISM): Entities are instantaneous stages that do not ultimately persist and do not temporally compose.

2.5 Exdurantism and diachronic identity

I have argued that radical exdurantism, *i.e.*, exdurantism free of mereological fusions of temporal parts, is our best metaphysical option. The premises of my argument are two principles: the Generality of identity and the Generality of diachronic identity. The line of reasoning from the premises to the conclusion is the following. If we accept both GoI and GoDI, we need a metaphysics that provides a unified treatment of all the phenomena of persistence. I have shown that endurantism cannot achieve this task, and perdurantism does not offer a satisfying characterization of the relation between temporal parts. On the contrary, radical exdurantism provides a

unified treatment and does not suffer from the problems of the circularity of the I-relation.

However, someone might argue that

1. The generality of identity leads to the Generality of diachronic identity on the assumption that
2. Diachronic identity is a genuine case of identity.
3. The generality of diachronic identity we need a unified treatment of all the phenomena of persistence;
4. The theory that satisfies this requirements without setbacks is radical exdurantism,

but

5. Radical exdurantism deny (2.).

In fact, according to radical exdurantism, nothing persists over time because entities are instantaneous stages, each of which is different at any instant. This line of reasoning concludes that diachronic identity never occurs, so the argument is invalid.

However, this perplexity does not affect radical exdurantism. Radical exdurantists deny that there is something that persists, *i.e.*, that there are actual instances of diachronic identity. This is extremely different from arguing that diachronic identity is not a genuine case of identity. On the contrary, according to radical exdurantism, diachronic identity, and synchronic identity are one and the same relation. In an exdurantist world, there is no such distinction as there is no actual persistence over time.

3. The Simplicity of Everything

Each of your sides
admires itself in the others.

Which is the favorite?
The one touching,
or the one facing?

But I was forgetting the angles
where the outside is irritating

to the point of taking away
your recurrent doubts.

Square

It can be argued that what I have defined as "the Simple View" is not simple at all, for it is not in line with our pre-philosophical intuitions. If, as I argue, to endorse the Simple View, one should accept what Heller (1990) might illustrate as a non-standard ontology[1]; it is revisionary as it implies changing our attitude towards what there is. However, endorsing an endurantist metaphysics would have the advantage of better complying with the commonsensical view about the persistence of objects rather

[1] Heller illustrates the standard ontology as the metaphysics according to which everyday objects like lamps, iPads, mountains, and people are three-dimensional objects that persist with a three-dimensional shape. The Simple View suggests a different ontology, encouraging us to drop three-dimensionalism in favor of exdurantism.

than with the Simple View framework based on generality. For this reason, perdurantism and exdurantism are required to meet the burden of proof by providing more arguments to defend themselves.

I acknowledge that this reason can lead us to seriously question this commitment demanded by radical views, but it is not a real argument in favor of the standard ontology, nor it is a motive to reject a thesis because of its counter-intuitive aspect. Besides, in many philosophical disagreements, there are standard positions as opposed to revisional theories. Take, for instance, the quarrels between dualism and materialism, nominalism and realism. The above-mentioned line of reasoning does not settle any of those disputes. The revisionists should accept that their theories entail an additional effort to become more intelligible and charming. Once the revisionists take this step, the conservatives, *i.e.*, those accepting the standard views, should not criticize the counter-intuitiveness of the formers' thesis. The attempt to equal out the intuitiveness should be paid back with the evaluation of the thesis only according to the coherence and the robustness of its arguments.

The Simple View – and the principles that it entails, namely the Generality of Diachronic Identity and the Generality of Persistence – is simple in as much as it offers a coherent and uniform way of treating persistence. Yes, it requires the revision of almost all our intuitions about time, change, and survival. But who can assure us that our intuitions are correct?

In this chapter, I will expand the Simple View from time to space by endorsing mereological nihilism. Recalling the last section of the previous chapter, I argue that, as a radical exdurantist advocates a defused world, she should have the same attitude towards spatial. In fact, if

she denies temporal composition and provides reasons against the existence of temporal aggregates, she should behave similarly concerning spatial aggregates.

3.1 From time to space

In the second chapter, I defended a theory of persistence, namely exdurantism. Exdurantism is more advisable than endurantism because of what I describe as "generality". I provided reasons supporting the idea that endurantism cannot offer a unified treatment for all the phenomena of persistence through time and change. On the other hand, a perdurantist can support what I call "the generality of persistence", *i.e.*, the principle that every case of persistence through time should be treated univocally. Nonetheless, perdurantism presents a downside: the relation between temporal parts is circular and non-informative. For this reason, I suggest rejecting perdurantism and opting for a radical version of exdurantism, free of four-dimensional aggregates.

The rejection of mereological fusions is not an easy bullet to bite. Indeed, exdurantism itself is quite a revisional thesis. The radical exdurantism I propose is a revisional version of a revisional thesis, and, of course, I do not expect it to be accepted easily. Nevertheless, if the relation among temporal parts is truly problematic and if classic exdurantism accepts fusions (even without any *metaphysical weight*, so to speak), then some kind of revision is needed.

Moreover, the defused version of exdurantism suggests a further step. Classically, exdurantists and perdurantists accept the mereological principle of unrestricted composition, according to which, for any entities, there exists their mereological sum (or fusion). If so, ag-

gregates of temporal parts, as exdurantists claim, come for free. But this, as I will explain, is not enough, at least for a radical exdurantist. For this reason, she should endorse mereological nihilism, the view according to which no composite objects exist. In the remainder of the chapter, I will present the basic features of mereology in order to provide a summary of mereological nihilism and its implications.

3.1.1 Ground mereology

Mereology is the theory of the relation of parts to whole and the relation of part to part within a whole. In the natural language, there is no univocal way to describe the concept of "to be part of". For example, when I say that "the handle is part of the door", "the left half is your part of the cake", "that area is part of the living room", "the second quarter is part of the game", "the gin is part of Martini", I am using the word part in four different ways. Respectively, to indicate a portion attached to the remainder, a part arbitrarily demarcated, an immaterial part, a temporal part, and to be part of a mixture composite[2]. Despite these diverse uses, we can characterize the very notion of parthood as indicating any portion of a given entity. This neutral notion of part is the cornerstone of mereology.

Classical mereology states that "to be part of" is a two-place relation with no ontological restrictions, so it applies to all entities, no matter their ontological category. Moreover, parthood relation is not relative to time, space, worlds, sortals etc. Furthermore, as Lewis (1991) states, mereology is considered "ontologically innocent". In fact, according to mereology, given certain objects, no

[2] Cf. Varzi (2024); Cotnoir & Varzi (2021).

further ontological commitment is required for the existence of their sum.

Hence, we can say that mereology is general, in the same way that, in the previous chapters, I argued identity is. And, as for identity, this characterization of mereology as general (or, in other words, neutral) has also been questioned[3].

The language of the theory is a first-order language supplemented with a distinguished, binary predicate constant, "P", to be interpreted as the parthood relation. The so-called "Ground Mereology" is the starting point theory, built from three proper axioms of

P.1	Pxx
P.2	$(Pxy \wedge Pyz) \longrightarrow Pxz$
P.3	$(Pxy \wedge Pyx) \longrightarrow x{=}y$

This is to say that, according to ground mereology, parthood relation is reflexive (P.1), that if y is part x and z is part of y, then z is part of x (P.2), and that if y is part x and x is part of y, then x is identical to y (P.3).

From the notion of part and (P.1), (P.2), and (P.3), other mereological predicates can be introduced:

(PP)	$PPxy \leftrightarrow Pxy \wedge \neg x{=}y$ [4]
(PE)	$PExy \leftrightarrow Pyz \wedge \neg x{=}y$
(OL)	$Oxy \leftrightarrow \exists z(Pzx \wedge Pzy)$
(UL)	$Uxy \leftrightarrow \exists z(Pxz \wedge Pyz)$

Take $\leftrightarrow$ to be "equivalent by definition". These predicates form the basis of the classic notion of mereology. According to (PP), y is a proper part of x iff y is part of x and y is not identical to x. On the other hand, y is a prop-

[3] See, for example, Mellor (2006) and Gilmore (2009).
[4] Simons (1987) and others use the formalism "x" y" to indicate the proper part relation.

er extension of x iff z is part of y and y is not identical to x (PE). It is the case that y overlaps x iff there exists z, such that z is part of x, and z is part of y. (OL) holds when x and y have a part in common, when x and y are the same object, or when x is a proper part of y – or *vice versa*. Also, it is the case that y underlaps x iff there exists z, such that x is part of z, and y is part of z. (UL) between x and y occurs when x and y do not overlap or do not share any part[5].

3.1.2 Decomposition and composition principles

Along with (P.1), (P.2), (P.3), (PP), (PE), (OL) and (UL), classical mereology can be extended in two ways: by means of decomposition principles, and by means of composition principles. The former considers the extension of the theory from a whole to its parts. The latter considers the extension of the theory from the parts to the whole.

Let us start with the decomposition principles. A strong intuition that goes along with ground mereology is that a whole cannot be decomposed into a single proper part. This is the so-called "supplementation" principle:

(SU) $\quad PPxy \longrightarrow \exists z(Pxy \wedge \neg Ozx)$

According to (SU), every proper part must be supplemented by another disjoint part, *i.e.*, there would always be a mereological difference[6]. A stronger and a weaker version of (SU) can be introduced in classical mereology:

(SS) $\quad \neg Pxy \longrightarrow \exists z(Pzy \wedge \neg Ozx)$
(WS) $\quad Pxy \wedge x \neq y \longrightarrow \exists z(Pzy \wedge Ozx)$

[5] Cf. Koslicki (2008, 12-3).
[6] Varzi (2024).

According to (SS), *i.e.*, strong supplementation principle, if y is not part of x then y has a part that does not overlap x. On the other hand, the weak supplementation principle (WS) states that if x is part of y, then y has a part that does not overlap x.

Furthermore, other two interesting notions can be introduced:

(AT) $Ax = \neg\exists y PPyx$
(AG) $Gx = \neg\exists y\,(Ay \wedge Pxy)$

An atom (AT) is an entity with no proper parts, regardless of whether it is point-like or has spatial extension. Instead, an atomless gunk (AG), if there exists such thing, is an entity that has no atoms that compose it.

The second group of extensions includes the so-called composition principles. It consists of the definition of mereological sum (or fusion), mereological product and mereological difference, unrestricted composition, and the uniqueness of composition:

(MS) $x + y \leftrightarrow \sigma\,(Pzx \vee Pzy)$
(MP) $x * y \leftrightarrow \sigma\,(Pzx \wedge Pzy)$
(MD) $x + y \leftrightarrow \sigma\,(Pzx \wedge Dzy)$
(UC) $\exists w \phi w \longrightarrow \exists z S_i z \phi w$
(UQ) $\exists x \phi x \longrightarrow \exists z(z = \sigma x \phi x)$

Let us focus on the last two principles, which will be helpful in the remainder of the chapter. According to unrestricted composition (UC), any *X*s have a mereological sum, while the uniqueness of composition. (UQ), on the other hand, tells that there are no *X*s that have more than one mereological sum.

3.2 Mereological Nihilism

In the previous section, I have introduced the principles of the classic mereology. Even if one accepts the metaphysical innocence of those principles, mereology opens the door to further analysis concerning the metaphysics of spatial composition. In fact, the commonsensical view is that composition only occurs among some things. If this is the case, (UC) is not a principle accepted by common sense.

As in many other fields of philosophy, deepening the metaphysical issues of our everyday attitude is a good guide to the comprehension of the alleged paradoxes that commonsense rises. This is not to say that we should always revise our pre-philosophical intuitions, but rather that we should keep checking them with our philosophical tools.

Consider the following scenario:

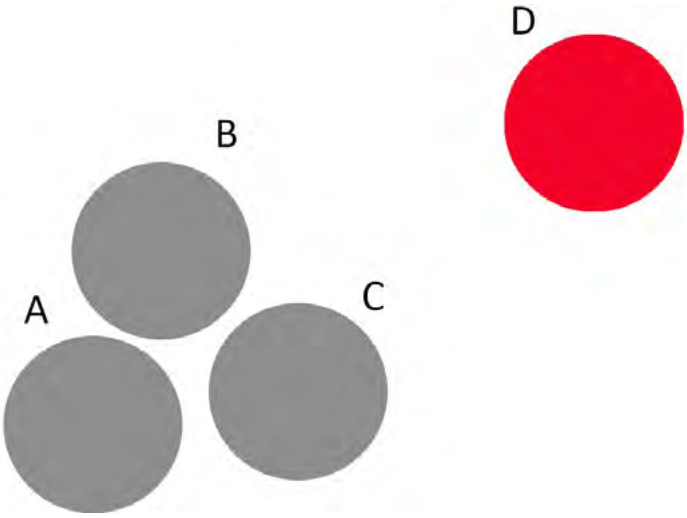


Fig. 3.1 Mereological World

Let us make it uncomplicated and consider A, B, C, and D as simple entities with no further parts besides themselves. Moreover, consider that A, B, and C are not only of the same shape, color, and appearance, but they also behave the same way. Suppose that when A moves to the right, B and C simultaneously comove to the right, just like the cells of a single organism, while D does not. If so, how many entities are in the figure 3.1?

The most common answer would probably be five: A, B, C, D, and the triadic unit A+B+C. This is because we find a regularity in the "behavior" of A, B, and C, suggesting that a further object exists, namely the sum of them. The same line of thought guides us in our everyday practices. In fact, we countenance the existence of galaxies, schools of fishes, bodies of human beings, collections of stickers, and a vast number of composite objects. But we leave out of our catalog of what there is a likewise vast number of "things". In our world, there is no room for things like the sum of my backpack and the vacuum cleaner. Even if I tie them or put the vacuum cleaner inside the backpack, nobody will believe in the existence of a back-cuum (va-pack, or whatever you may call it).

Let us define this standard way of thinking as "the ordinary ontology":

(ORD-ON) All and only ordinary objects exist.

It is rather unclear how one should explain what ordinary objects are. As a matter of fact, we are not puzzled when asked, "Is x an ordinary object?" while we would rest clueless when required to provide a good general criterion for what an ordinary object is.

The discussion about ordinary objects is extensive. Nevertheless, it relies on a general and intuitive characterization of what a thing needs to be an ordinary ob-

ject. The defense of ordinary ontologies usually lies on the strength of our commonsensical intuitions (which, of course, leaves the opponents dissatisfied)[7]. As Rosen and Dorr (2002) note, «common sense does not deliver an explicit rule or principle governing composition. But it does have firm opinions about particular cases» (p. 160). Nobody outside the Philosophy Department would doubt the existence of aggregates like bodies, neighborhoods, chairs, and so on. Nevertheless, this lack of clarity about the composition of material objects leaves room for philosophical inquiry.

3.2.1 Setting the Special Composition Question

Peter Van Inwagen (1990, 31) asks the famous question:

> What would one have to do – what could one do – to get the *x*s to compose something?[8]

which has been addressed in many ways by many authors. Following Markosian (1998a, 212), it can be restated as follows:

(SCQ) What necessary and jointly sufficient conditions must any *x*s satisfy in order for it to be the case that there is an object composed of those *x*s?

From what van Inwagen calls the Special Composition Question (henceforth, SCQ), the debate over composite objects, ordinary objects, and the composition itself has become very active. Whether objects compose other objects is not only an interesting question from a theoretical point of view, but it becomes substantial when

[7] See Thomasson (2007); Sattig (2012); Lowe (2005); Unger (1979); Hawthorne (2006, § 7); Korman (2014).

[8] «We shall use the expression "the *x* s composes *y*" as an abbreviation for "the *x*s are all part of *y* and no two of the *x*s overlap and every part of *y* overlaps at least one of the *x*s".» Van Inwagen (1990, 28-9).

certain metaphysics do not allow composition or some others countenance the existence of composite objects. The endorsement of a certain metaphysics determines the choice of adopting a certain answer to the SCQ and *vice versa*. Before analyzing this strong link, let's examine the answers to the SCQ.

We can draw a line between uniform and non-uniform answers[9]. The uniform

answers try to reconcile the commonsensical intuitions. They consider different grades of composition, from weak to strong relations:

(CONTACT) The *x*s compose an object *y* if and only if the *x*s are in contact.

(FASTENING) The *x*s compose an object *y* if and only if the *x*s are fastened together.

(COHESION) The *x*s compose an object *y* if and only if the *x*s are sticked together.

(FUSION) The *x*s compose an object *y* if and only if the *x*s are fused.

Van Inwagen states these four options cannot be considered good answers to the SCQ. Indeed, it is not difficult to find counter-examples for all the cases:

(CO) Two objects can be in contact and still do not compose a further object. When I hug my dog, even if we are in strict contact, we do not form an object composed of my dog and me.

(FA) Even if we make the contact more stable, it does not work. When I am on a plane following the safety instructions, I fasten my seatbelt. But the fact that the

[9] Cf. Thomasson (2007, 127-34).

seat I am sitting on and I are fastened together does not entail that we compose a further object.

(CO) Even if, say, we glue the backs of two human beings, it would not be the case that a third object, the one composed of two human beings, enters the scene.

(FU) Consider a case where two persons, Anna and Bert, fuse and call the result of the fusion Carl. Despite their fusion, nothing is such that Anna and Bert compose it. Anna and Bert no longer exist[10].

The non-uniform answers are the so-called "series-style answers", which take the following form:

(S-SA) (There exist *y* such that the *x*s compose *y*) if and only if the *x*s are F_1 and stand in R_1, or the *x*s are F_2 and stand in R_2, or ..., or the *x*s are F_n and stand in R_n.

The series-style answers leave open the option of treating different kinds of things with different relations. The schema (S-SA) can be considered as "(There exist *y* such that the *x*s compose *y*) if and only if the *x*s are Lego blocks and stand in the relation of *being sticked together*, or the *x*s are cotton swatches and stand in the relation of *being stitched*, or the *x*s are planks and stand in the relation of *being assembled in a ship-shape*, and so on. This kind of answer does not offer a unified response to the SCQ but makes the answer possible. Van Inwagen criticizes (S-SA) mainly by arguing that this kind of answer is circular and makes the parthood relation non-transitive[11].

[10] Van Inwagen considers the commonsense perspective. By considering different metaphysical theories, like perdurantism, Anna and Bert still exist, even if they fuse.
[11] See Van Inwagen (1990, 64-6) for the complete arguments.

Besides the wide debate about this circularity and non-transitivity issues, a remark by van Inwagen himself is worth noting. The fact that some kinds of objects may compose further objects while others may not is problematic. Take the Ship of Theseus case. A certain number of planks may form a ship if they are fastened together and arranged in a specific way. Human beings, on the other hand, may not. If gathered under certain circumstances, they may form a soccer team, while planks may not. This compositional difference leads to a metaphysical one. Van Inwagen concludes that this kind of ontological discrimination is not justified. Even if someone could reply that a certain ontological difference can be defended, series-style answers suffer from a problem of vagueness. Once we have drawn a line between, to say, human beings and planks, it is not difficult to instantiate a version of the argument from vagueness I have introduced in the previous chapter[12].

3.2.2 Universalism and Nihilism

Once van Inwagen has ruled out commonsensical and series-style answers, he faces two general responses to SCQ, namely universalism and nihilism:

> (UNIVERSALISM) The *x*s compose an object *y* if and only if the *x*s exist.
>
> (NIHILISM) The *x*s compose an object *y* if and only if there is exactly one of the *x*s.

Universalism follows the mereological principle of unrestricted composition I have introduced in the previous section:

[12] As noted, the classical argument from vagueness can be found in Lewis (1986) and Sider (2001a).

(UQ) $\exists x \phi x \longrightarrow \exists z(z = \sigma x \phi x)$

while nihilism rejects it. This is to say that, according to universalists, for every pair of objects, there is a further object, while for nihilists, there is not such a thing as a composite object. Unrestricted composition is a theorem of classical mereology, but it is very far from the commonsensical intuitions about the ordinary ontology. The universalist countenances the existence of a multitude of entities that would not fit outside of the Philosophy Department – indeed, most of her ontology has no place in (ORD-ON). On the other hand, the nihilist's ontology is a subset of the commonsensical one. According to the nihilist, there are no chairs, trees, or people. However, she includes in her ontology the basic entities, whatever they are, that compose such things: «any region of space that one might have thought contained a cat or a star in fact contains only elementary particles» (Van Inwagen, 1990, 72).

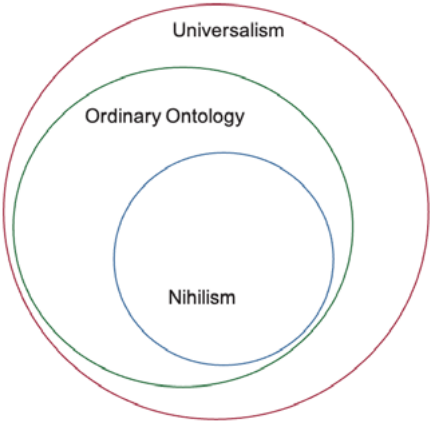


Figure 3.2: Different ontologies

Van Inwagen rejects both universalism and nihilism. According to him, universalism can be demolished in a six-step argument:

1. I am now, and I existed ten years ago;
2. I am a biological organism, and I have always been so;
3. Every organism is composed of some atoms at every moment of its existence;
4. Consider any organism that existed ten years ago; all of the atoms that composed it ten years ago still exist;
5. Consider any organism that exists now and existed ten years ago; none of the atoms that now compose that organism is among those that composed it ten years ago;
6. If Universalism is true, then it is impossible that $\exists y \exists z \exists w \exists v$ such that the *x*s compose y at the moment w, and the *x*s compose z at the moment v, and $y \neq z$.[13]

While nihilism is closer to van Inwagen's answer, it is criticized because it «would appear to be false, for you and I exist and we are composite objects»[14]. For this reason, the answer proposed by van Inwagen himself takes this commonsensical intuition into account:

(LIFE) The *x*s compose a y only if the activities of the *x*s constitute a life.

This move would partly preserve our intuitions about certain objects, namely living things, and it is not com-

[13] For a defense of universalism, see, among the others, Lando (2017); Rea (1998)
[14] Van Inwagen (1990, 73). See, among the others, Brenner (2015).

mitted to universalism and nihilism, nor is it affected by the problems that series-style answers have.

However, although (LIFE) is a proposal in line with van Inwagen's critiques of the other answers to the SCQ, it is not immune to criticism. The opponents of (LIFE) can be divided into three groups: (i) the ones who are not convinced by van Inwagen's critiques of series-style answers, universalism, and nihilism; (ii) the ones who think (LIFE) is not a tenable option tout court; the ones who believe both (i) and (ii).

Here, I am not offering reasons to deny (LIFE). For my purpose, it is sufficient to note that van Inwagen's critique of nihilism cannot be considered decisive. As a matter of fact, I do not think it is even a critique of the nihilist. Her ontology is such that people and other biological organisms do not exist. However, as van Inwagen himself admits, it does not mean that the regions of space filled up by what the commonsense ontology calls persons are empty. Indeed, there is something, namely elementary particles.

This is not to say that the disagreement between nihilists and – in this case – the commonsense ontology is purely verbal. The two ontologies are quite different; it is not only a matter of how we describe the world. But a critique according to which nihilism is false because there exists something, me, that is a composite object, is a way of setting the dispute at a verbal level, not a way to contrast the view. Consider a region of space R. Now, we can reformulate van Inwagen's objection: "In R, there is a person, me, that is a composite object. So nihilism is false". The nihilist could easily reply that "In R, there is a number of particles arranged person-wise". And she could also add that "If there were no persons, only particles arranged person-wise, our sensory experience would

be the same"[15]. The nihilistic description of reality is less absurd than it seems prima facie. However, it is a deep revisionary theory with an ontology that differs greatly from the commonsensical one. The discussion about the right answer to the SCQ is still open, and my intent here is not to offer a solution to it[16]. Even if his answers can be criticized, Van Inwagen addressed the right question.

In the next section, I will provide a conditional argument in favor of nihilism, based on the acceptance of the radical form of exdurantism I have presented in the second chapter.

3.2.3 A conditional argument for nihilism

I present a conditional argument for supporting nihilism. It is as follows: if radical exdurantism is true, then the "natural" approach to spatial composition is nihilism. So, if nihilism is a viable way, exdurantists should embrace it.

As I have outlined in the previous section, the debate around the answers to the SCQ has not reached a conclusive point. The general argument against the moderate answers (contact, fastening, cohesion, fusion) and the related criticism of series-style answers leaves the door open to mereological universalism and nihilism. If so, the

[15] Cf. Dorr (2002); Sider (2007b, 2013).

[16] Among the others, I have not discussed here a famous reply to the SCQ, given by Markosian (1998a):

> (BRUTE) It is a brute fact that the *xs* compose an object *y*.

According to him, there is no way to answer SCQ properly because there are no rules of composition: it is a brute fact. «Whenever composition occurs . . . it is just a 'brute fact' that the relevant objects compose something, and whenever composition fails to occur, this too is just a 'brute fact'». (p. 214)

exdurantist who wants to take a stand towards spatial composition needs to choose one of them[17].

By endorsing nihilism, the exdurantist could offer a unified treatment to all phenomena of spatiotemporal extension. In this world, populated exclusively by atomic entities, everything would be world-bound, time-bound, and space-bound. All appearances of extension through space, time and possible worlds would then be explained away in the very same manner, *e.g.,* by appealing to a counterpart relation linking numerically different atomic entities (Varzi, 2003a), by paraphrasing away our talk about extension in terms of pluralities of atoms and their arrangements (Sider, 2013), or, again, by appealing to fictionalist accounts of the semantics of our everyday terms referring to allegedly extended entities (Rosen and Dorr, 2002).

3.2.4 How to be exdurantist and nihilist: pixelism

I have suggested that nihilism is the attitude towards spatial composition that a strong exdurantist should adopt. This is because she does not accept temporal composition, *i.e.*, she believes that entities are not aggregates of temporal parts. No temporal composition occurs. There are only temporal parts that, actually, are no parts of anything. So, the ontology of an exdurantist is composed of spatio-temporal slices. Given this lack of temporal composition, I have argued that there are no valid reasons to appeal to the spatial composition by endorsing universalism.

[17] It can be argued that moderate answers could be endorsed, yet in a different manner. There is indeed no knocked-out argument. However, the radicalness of the exdurantism I have brought into focus is incompatible with such answers.

However, exdurantists usually endorse mereological universalism. If Varzi (2003a) takes advantage of the fact that mereological fusions "come for free", namely they do not require a further ontological commitment in addition to the one exdurantist make for the slices, Sider (2001a) takes a resolute stand in favor of universalism, by appealing to two arguments. The first comes from Lewis (1986, 212-3) and his "argument from vagueness". It can be summarized in five passages[18]:

1. If universalism is false, then there can be a sorites series for composition.
2. Every sorites series must contain either borderline cases of composition or a cut-off with respect to composition.
3. There cannot be borderline cases of composition.
4. There cannot be cut-offs with respect to composition.
5. Hence, universalism is true.

Assume, for the sake of discussion, that it works. It is not a proper argument in favor of universalism because it does not consider the nihilistic view. In other words, the argument from vagueness rules out what van Inwagen would call a "moderate" attitude towards composition, but it leaves the door open to both universalism and nihilism. Nihilism blocks the argument at premise (1.), arguing that composition never occurs – so there cannot be a sorite for composition.

For this reason, Sider provides a further argument against nihilism, taken from his Sider (1993). He states that nihilism is incompatible with the metaphysical possibility of atomless gunk. As I introduce in section 3.1,

[18] Cf. Korman (2010, 891).

an atomless gunk is «an individual whose parts all have further proper parts» (Lewis, 1991, 20). As defined this way, atomless gunk is certainly incompatible with nihilism because nihilism itself cannot countenance the existence of a thing that can be infinitely divided into smaller and smaller parts.

I consider two possible answers to this criticism. The first is provided by Dorr (2002, 68-9). He follows a Kripkean view of semantically defective predicates and argues that «since 'gunk is possible' can be true only if there is actually such a relation as parthood, it doesn't seem to be the sort of thing that could be established just by "conceivability" evidence». The second one is provided by Sider, who recently revised his opinion. In fact, he argues that the mere possibility of gunk does not defeat nihilism. This is because he offers a reductive analysis of metaphysical modality, namely "modal Humeanism", according to which necessity «does not carve at the joints» (2011: 269). Hence, metaphysical statements that lie on arguments from possibility (as his own argument against mereological nihilism) are just a hodgepodge of certain kinds of truths, which is not particularly interesting or unified[19].

Here, I am not taking a stand towards Sider's proposal of the epistemology of modality, nor am I arguing in favor of Dorr's solution to the possibility of gunk. I have considered these replies to show that the suspicious attitude that some exdurantists have towards nihilism can be softened. It is true that, according to classical mereology, aggregates come for free, and the commitment to their existence is not problematic. I suggest that if an exdurantist denies temporal composition and endorses universalism, then she has the burden of proof. Why should an ex-

[19] Cf. Sider (2011, ch. 12); Sider (2013, 276-7).

durantist reject nihilism, which seems a theory more in line with her philosophical attitude?

3.2.5 The difference between universalism and nihilism?

In the last sections, I have analyzed the debate originated from the different answers to the SCQ. My sympathy for nihilism lies in the fact that it follows from radical exdurantism, if not as a direct consequence, at least as a similar philosophical position. Once we have established that no temporal composition occurs, it is painless to opt for a theory that seems symmetrical to exdurantism with respect to spatial composition. The conjunction of radical exdurantism and mereological nihilism is a coherent and elegant way to describe reality.

This idea could be criticized in several ways. An immediate objection is that I am not proposing any independent argument to support nihilism. That is true. However, I specifically propose the analogy between radical exdurantism and nihilism as a conditional argument.

There is a further objection, though, that could contrast my analogy. Someone might argue that, ultimately, nihilism and universalism are not substantially different[20]. One could argue, as Slater (2009), starting from the assumption that the whole is nothing over and above the parts, that the difference between the two theories is purely arbitrary. In fact, the slogan "the whole is nothing over and above the parts" is endorsed by most universalists, given their acceptance of classic mereology (which seems, as Sider (2015:192) points out, that «one can think of the axioms of classical mereology as being in some sense underwritten by the slogan, much as (some of) the axioms of Zermelo-Frankel set theory are often regarded

[20] The same dialectic can also be iterated for temporal composition.

as being underwritten by the intuitive iterative conception of set». And if so, the critics argue, the ontology of universalism and nihilism coincide.

This objection may lead to consider the analogy less pleasant and may, in fact, lead supporters of nihilism and universalism to reconsider their position. Even if, for the sake of discussion, we accept the extreme conclusion of the objection, *i.e.*, that classical mereology leads nihilism and universalism to be just arbitrarily different, there is a counter-objection nihilists (and universalists) can oppose it. It can be replied that there is at least one substantial difference between nihilism and universalism. Nihilism, in fact, leads to the acceptance of atomism, *i.e.*, the idea that reality is ultimately composed of atoms[21]. On the other hand, universalism does not. On these premises, the differences between universalism and nihilism cannot be said to be merely arbitrary.

[21] Even the possibility of atomless gunk does not prevent this kind of answer.

4. Pixelism

It would be a good thing, I think,
to solder together again
these separated pieces

that don't even remember
who cut them up

and that wish, for want of
being a continuous line,

to pop off and look
at the volume.

Dotted line

In the previous chapters, I defended a radical form of exdurantism. I suggested that radical exdurantists should embrace the spatial analog of the thesis they support, i.e., mereological nihilism. The world of a supporter of radical exdurantism and mereological nihilism is such that no composition occurs. Call "pixelism" the conjunction of radical exdurantism and nihilism.

Pixelism's worldview consists of a world of single entities, which are combined (both spatially and temporally) only fictionally in our everyday lives. I will present pixelism by analogy with computer pixels. A computer screen is composed of millions of pixels, where each pixel represents the smallest addressable element. Like pix-

els that do not actually merge to create the images we see, exdurantist entities do not undergo temporal composition, and nihilistic entities do not undergo spatial composition. What we perceive as unified is simply a combination of individual characteristics that our perception unifies into a single image.

This is, roughly speaking, what happens in a two-dimensional model constituted by pixels. My idea is to develop this analogy into two models for pixelism. There are two viable options: the first one takes pixels to be hypercubes, i.e., four-dimensional cubes, the acceptance of which is conditional on the acceptance of extended simples. The second one considers pixels as points in a four-dimensional space.

Such geometrical depictions have many advantages. First, they provide a way to consider under a different light the metaphysical implications of pixelism; second, they permit to analyze in a very simple way the modal implications of the theory I am defending; third, they easily allow to grasp what I intend with "the simplicity of everything". Everything is simple because, ultimately, entities persist, compose, and exist in different worlds in the same way, namely as pixels in a five-dimensional space consisting of three spatial coordinates, the temporal one and the modal one.

4.1 A world of pixels

In this section, I will explain pixelism within an analogy. Through this, I will describe the characteristics of a four-dimensional space of pixels intended as hypercubes (§4.1.1) or points (§4.1.2). These geometrical models allow us to explain in a very simple manner the relations between the entities pixelism countenance the existence of.

Consider the screen of your computer. It works by having millions of pixels. A pixel is the smallest addressable element of what is represented on a screen. The images you see on it result from the process involving each pixel. Each pixel represents the smallest portion of what you see on the screen. The result is a combination of the characteristics of all the single pixels that we unify perceptively as a unique image. I will employ this example to develop two models of a metaphysical view I call "pixelism", namely the conjunction of exdurantism, mereological nihilism, and counterpart theory. Pixelism's worldview consists of a world of single entities, which are combined (both spatially and temporally) only fictionally in our everyday lives. There are no persisting chairs, cats, or skyscrapers, but various combinations of pixels arranged chair-wise, cat-wise, and skyscraper-wise. The temporal dimension is analog to the spatial ones in all respects.

This idea can be efficiently illustrated with a geometrical model in which entities are four-dimensional pixels in a four-dimensional Euclidean space. Moreover, if we add a further dimension, the modal one, we can describe a five-dimensional world in which all the spatial extensions have the same characteristics. The modal analog of mereological nihilism and radical exdurantism is counterpart theory, i.e., the thesis according to which entities are world-bound individuals.

As pixels do not actually "merge" to depict what you see on the screen, exdurantist entities do not actually go under temporal composition, and nihilistic entities do not go under spatial composition. My idea is to develop this analogy into two models for pixelism. There are two viable options: the first one takes pixels to be hypercubes, i.e., four-dimensional cubes, the acceptance of which is

conditional on the acceptance of extended simples. The second one considers pixels as points in a four-dimensional space.

Such geometrical depictions have many advantages. First, they provide a way to consider under a different light the metaphysical implications of pixelism; second, they permit analyzing the modal implications of such a theory in a very simple way; third, they show the elegance of pixelism: ultimately, entities persist, compose, and exist in different worlds in the same way, namely as pixels in a five-dimensional space, consisting in the three spatial coordinates, the temporal one, and the modal one.

4.1.2 The Dancing Ballerina

Pixelism's worldview consists of a world of single entities, which are combined (both spatially and temporally) only fictionally in our everyday lives. I introduce two models for pixelism, starting from the following analogy. Each pixel of the screen of your computer represents the smallest portion of what you can see on the screen. If you want to locate a given pixel on the screen, you should provide a univocal name for each pixel. The easiest way to achieve this task is to visualize pixels as having univocal coordinates. Take the pixel in the upper left side of the screen and call it (0,0). From (0,0), if you move right to the next pixel, you will have a pixel named (1,0). If from (0,0) you move down to the next pixel, you will have a pixel named (0,1). If so, the pixel named (n,m) would be the one located n pixels from (0,0) moving left, and m pixel from (0,0) moving down. Within this coordinate system, we not only give a univocal name to each pixel, but we are also able to accomplish two additional objectives: (i) identify which pixels are close to a given pixel – if we take the pixel (3,5) we know it is adjacent to the pixels

(2,5), (4,5), (3,4), (3,6), and that it shares its four vertices with pixels (2,4), (4,4), (2,6), (4,6); (ii) determine the area of a given region of pixels.

What if we have more than one screen? Suppose that we have many flat screens stacked one above the other. In this case, our previous coordinate system is not sufficient to univocally identify a given pixel. In fact, each screen would have one pixel named (0,0), namely the pixel in the upper left side of each screen. By all means, we can give an account of the specific screen in which a pixel is located by adding this information to the pixel's name. Take the pixel (*n*, *m*) located on the lower screen of the stack. Its univocal name would be (*n*,*m*,0). So, the pixel (3,8) located on the fourth screen from the bottom of the stack would be (3,8,3), and so on. Given this new coordinate system, we are able, in addition to (i) and (ii), to determine also (iii) the volume of a given number of pixels.

Now, with this three-coordinate system of pixels, we can create a 3D image. To do so, we just need to identify specific pixels (and we can do it for each pixel of every screen) and, say, make some of them white and some others black. This way, we can draw a black ballerina silhouetted against a white background. What if we wanted to transform the 3D image into a moving picture? How can we make the ballerina dance? We would need, for every instant, a different configuration of the color of the pixels. We could also create different configurations by adding an additional coordinate to the pixels as if every instant corresponds to a screen further than the ones previously considered. Take the pixel (*n*,*m*,*p*). At the instant 0, it would be named (*n*,*m*,*p*,0), while at the instant q, it would be the pixel univocally identified by the coordinates (*n*,*m*,*p*,*q*). This means that, just as all and only the pixels of the second screen would be named in the fol-

lowing way (*n*,*m*, 1, *p*), all and only the pixels at the instant 24 would be named in the following way (*n*,*m*,*p*, 24).

Through this four-coordinate system, we can still talk about "distances" with respect to every coordinate. Take the following pixels:

1. (1,3,1,0);
2. (1,2,1,0);
3. (0,0,1,0);
4. (2,3,1,1);
5. (1,0,1,0);
6. (32,1,2,4).

We can extrapolate a large number of data from their coordinates. For example, (1) and (2) are adjacent along the second coordinate, as (3) and (5) are along the first. Pixels (1), (2), (3), and (5) share the three spatial and temporal coordinates: they take place at the same time with the same depth. (6), however, is very distant from the others.

This example shows how we can equally manage information about pixels. The concept of distance and proximity[1] can be applied to all the coordinates in the same way. Every information is codified by a number, and every pixel is described on the basis of the information, *i.e.*, its coordinates.

4.1.2. From Screens to Hyperspace

Now, let us apply this informational system for pixels to pixelism. Take the screens to be dimensions and the pixels of the screen as the entities that crowd our world. With entities, I am not considering chairs, skyscrapers,

[1] Following Di Concilio and Gerla (2006) and Coppola and Gerla (2014), we can build a pseudo-metric that allows us to define the concepts of "distance" and "proximity" in a non-metric system.

or forests because they are not present in the pixelist ontology: ordinary composite objects, strictly speaking, do not exist. Pixelism, like the other deflationist views about composition, considers them as arrangements of atomic entities. Accordingly, there are no chairs, but pixels arranged chair-wise. Thus, it is for all composite objects. Similarly, entities do not extend temporally. Persisting entities are arrangements of pixels. Following the exdurantist position, the arrangement of pixels you are now is not identical to the one that started reading this book. The pixel configuration is different in so much as the two arrangements are temporally distinct.

The four dimensions originate a four-dimensional Euclidean space. As I have introduced in the screen analogy, in a two-dimensional Euclidean space, every pixel is located by two coordinates and has two perpendicular directions. Three-dimensional Euclidean space is like the space we have experience of, where every point is located by three coordinates. There are three mutually perpendicular directions (the usual spatial directions: height, width, and depth). Equally, in a four-dimensional Euclidean space, every point is located by four coordinates, which correspond to four perpendicular directions[2].

In the screen metaphor, all the quantities are discrete. The space of the screen is divided into pixels, and we can say that the two-dimensional pixel (1,1) is one unit to the

[2] These models are pre-relativistic. As I have introduced in the previous section, in Euclidean four-dimensional space, every pixel has a unique name consisting of a description of its coordinates. The four dimensions correspond to the three spatial dimensions and time. This model has no distinction between them: time is just another coordinate. Even if some interpretations of quantum mechanics suggest that reality may be composed of punctual entities in a relativistic four-dimensional spacetime – cf. Lam and Esfeld (2012) - I am not taking the model I propose as a description of physical reality, nor am I committed to a spacetime model of reality *tout court*.

left of the pixel (2,1). And every step is precise: given that pixels are the smallest addressable units, we cannot move a quarter of a pixel down. It is like a chessboard. When we look at the model, we are like the king. The king cannot move 1,5 squares; it can move 1 square in every direction. And so can we. Nevertheless, when we talk about distances, it is reasonable to think of a not-discrete space, i.e., a space in which quantities are continuous.

Out of the metaphor, if we think of the pixels on the screen in a discrete space, we surely can picture a two-dimensional model in which the pixels are square-like. Adding dimensions, the square would become a cube (in three dimensions) and a hypercube (in four dimensions). This is the first model for pixelism I will present in § 4.1.3. We need a different characterization if we think of pixels in a continuous space. In fact, in such a space, we may be interested in the entities in between the hypercubes. Consider again the two-dimensional pixels. In a continuous model, the pixels (1,1) and (2,1) are not simply one to the left of the other. Every square is composed of segments, which in turn are composed of points. In a four-dimensional model, the circumstances are even more complicated. As it will be clear, every hypercube is composed of cubes, which in turn are composed of squares, which in turn are composed of segments, which in turn are composed of points. Hence, the hypercubes model would not be adequate for a continuous space. In this case, we can use the second model I propose, which considers pixels as points, as explained in § 4.1.4.

4.1.3 Hypercubes

To build a model of pixels as hypercubes in a four-dimensional space, let us start with a zero-dimensional space. A point is a hypercube of dimension zero. In

a one-dimensional space, when we move this point one unit length, it forms a line segment, which is a unit hypercube of dimension one. In a two-dimensional space, when we move this line segment one unit length in a perpendicular direction, it forms a square. In a three-dimensional space, when we move the square one unit length in a direction perpendicular to its plane, it forms a cube.

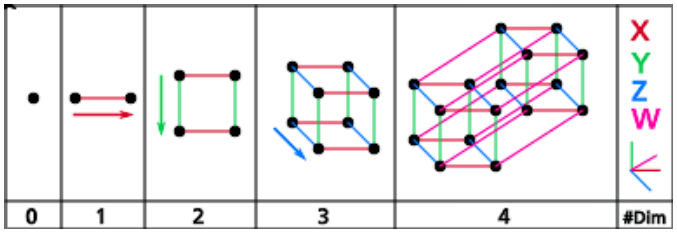


Figure 4.1: Bi-dimensional pixel (square) and Three-dimensional pixel (cube)

Finally, when moving the cube one unit length along the fourth dimension, it forms a four-dimensional unit hypercube (see Figure 4.1).

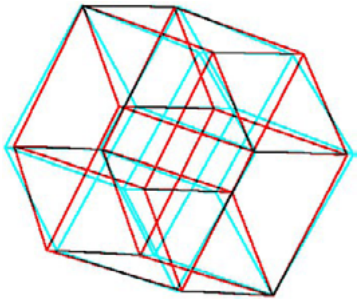


Figure 4.2: Four-dimensional pixel (hypercube)

In this model, the hypercubes amount to the pixel in the screen metaphor. Every hypercube may be identified

by a univocal name, given by its coordinates along the four dimensions. We cannot "draw" a world composed of hypercubes because we cannot render the fourth dimension. However, we can conceive it the same way we imagine a three-dimensional space filled up with cubes (see Figure 4.2).

In this model, the relations between hypercubes along the four dimensions are of the same kind. Theoretically, we could describe the world in all its parts by writing down the coordinates of the pixels. We would describe the persistence and composition of pixels in the same way we can describe a chess game by the movements of the pieces. The only difference is that, unlike chess pieces, pixels do not really move, unless fictionally.

4.1.4 Points

Accepting the hypercube model seems to bring to the acceptance of extended simples. An extended simple is a material entity extended in space that, nonetheless, lacks proper parts. Even if we take the hypercube as the smallest unit in a four-dimensional space, it is composed of the smallest elements, namely cubes, squares, segments, and points.

The concept of extended simple coincides with the Democritean[3] concept of the atoms that ultimately compose the world and the possibility of such a thing has been discussed not only in metaphysics but also in fundamental physics[4]. Among the others, Markosian (1998, 2004), Simons (2004), Parsons (2000), and McDaniel (2007) argue in different ways the possibility of extended simples. The opponents of such a view consider reality composed

[3] Or Leucippean, if you prefer (cf. Berryman 2021).
[4] As noted by McDaniel (2007), the existence of simple can also be entertained in string theory (Green 1999).

of atomless gunks or non-extended simples. An atomless gunk is an atomic unit whose parts all have proper parts, which all have proper parts, and so on, while a non-extended simple can be conceived as a point-sized unit. A model for pixels as atomless gunks can be produced in the same way as the hypercubes one. In such a model, quantities should be discrete, too. We can imagine the atomless gunk model containing hypercubes that contain hypercubes ad infinitum.

On the other hand, a pixel model for point-size entities is different from hypercubes and atomless gunk hypercubes in so much as the quantity of the corresponding space is continuous. This means that the space is completely filled up by punctual entities (and so, for any real numbers, there exists a coordinate).

As pixels on the screen are univocally identified by their coordinates, so are points in an Euclidean space (see Figure 4.3).

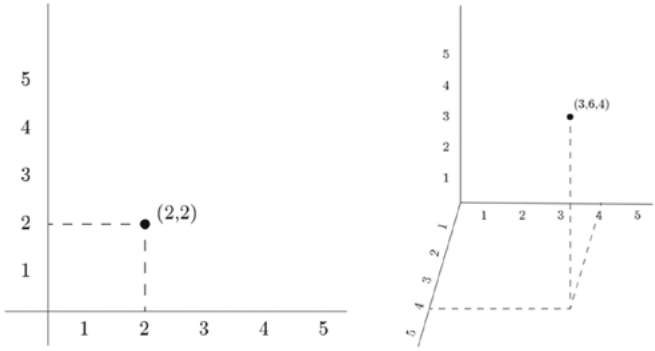
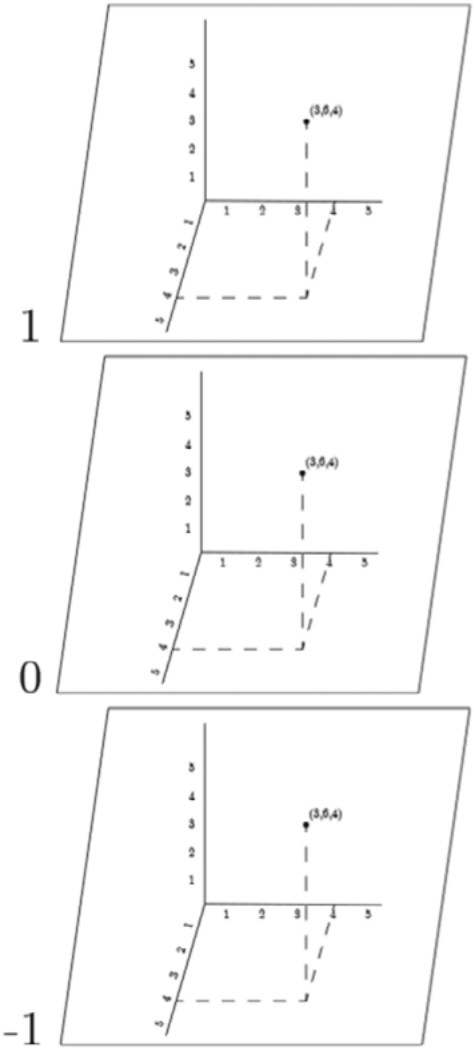


Figure 4.3: Points in 2D and 3D

As in the hypercube model, we cannot display the fourth dimension. We can represent it as a collection of

hyperplanes, i.e., a stack of three-dimensional subspace (see Figure 4).8



4.2 Potential sums and (counter)parts

So described, the two models have the advantage of univocally depicting spatial and temporal relations. There is no difference between spatial distance and temporal distance. This idea lies at the core of a four-dimensional approach to metaphysics, not only to pixelism. In fact, perdurantism and exdurantism maintain this uniformity also in respect to composition by endorsing universalism. As every sum of temporal parts composes a temporal aggregate, every spatial part composes a spatial aggregate.

Pixelism maintains this uniformity in the reverse direction. In a pixel world, there is neither temporal nor spatial composition. This theory successfully captures the spirit of exdurantism, unlike classical versions of exdurantism that accept temporal aggregates and endorse universalism. The above-mentioned models describe how a pixelist account can offer a unified treatment to all phenomena of spatiotemporal extension. All appearances of extension through space and time would then be explained away in the very same manner, e.g., by appealing to a counterpart relation linking numerically different atomic entities (Varzi 2003a).

Here, I assume that spatial and temporal relations between temporal parts can be interpreted as counterpart relations. Within these models, we can now extend this framework to modal relations between pixels, applying the same approach used for space and time. To accomplish this extension, it becomes necessary to reformulate the notion of spatial part in counterpart-theoretic terms. Three alternatives prove useful for our reformulation. The first emerges from mereotopology, specifically through Casati & Varzi's (1999) concept of "potential part." The second approach is borrowed from the concept of the "er-

satz part" (Markosian, 1998; Miller & Hariman, 2017). The third option, developed by Cotnoir (2013), builds upon the structural analogy between modality and temporality. All these frameworks provide valuable conceptual resources for our pixelist ontology.

4.2.1 Potential sums

Mereotopology treats all parts as objects of quantification—full-fledged entities endowed with the same right to existence as the wholes to which they belong. Casati & Varzi (1999) argue that in cases like the left and right halves of a board or the stem and the rest of a glass, such parts seem much less conspicuous and are of lesser cognitive salience, as their boundary results from an imaginary demarcation. According to them, undetached parts might be treated solely as potential objects. In the cases mentioned before, their goal is to «make sure we are talking about things that are purely potential-parts that are not individuated except by reference to the wholes to which they are attached» (Casati & Varzi, 1999: 101).

Casati & Varzi incorporate possible worlds directly into the first-order logic domain of quantification, expressing in this way modal facts through quantified statements about possible worlds. In this approach, necessity becomes universal quantification, and possibility becomes existential quantification, enabling us to discuss parts and wholes across different worlds within a familiar logical framework. Since the notion of a potential object is a modal concept, it requires quantifying over both whole objects and their parts, which belong to different possible worlds. Hence, they define mereotopological primitives as three-place predicates:

(P') $Pxyw$

(C) *Cxyw*

Where (P') is read as "*x* is part of *y* in world *w*", the predicate for connection (C) is read as "*x* is connected to *y* in world *w*'. Casati & Varzi retain the standard binary mereotopological predicate P for parthood but use the counterpart theory of modal logic to express modal facts. According to counterpart theory, modal facts about an entity are non-modal facts about its counterparts in other possible worlds. Potential parts, then, can be seen as partial counterparts of the wholes they belong to, inhabiting different possible worlds.

Accordingly, "x is a proper undetached part of y" can be expressed as: "in some possible world w' accessible from the actual world w, there exists an object x that is a partial counterpart of y". The mereotopology stays the same, and treating parts as potential is just a matter of situating them in different possible worlds relative to the wholes they are related to.

Casati & Varzi's goal is to find a way to speak about things that are purely potential - parts that are not individuated except by reference to the wholes to which they are attached. A pixelist, in contrast, wants to discuss pure potential wholes, given that since nothing composes anything, aggregates are only potential.

In this sense, we can easily paraphrase Casati & Varzi's account from a pixelist point of view. Just as «the undetached north half of the board is not an object to be included in an inventory of the world over and above the board itself, even though both of them are included in the domain of our part-whole theory» (1999: 101), mereological fusions are not objects to be included in an inventory of the world over and above the pixels that allegedly compose it, even though both the pixels and the sums

could be included in the domain of our part-whole theory. In this vein, we can introduce the notion of a "potential sum":

> (POTENTIAL SUM): an arrangement of pixels belonging to different possible worlds than the pixels it is fictionally composed of.

This framing allows accommodating the idea of potential parts without modifying the core mereotopological framework. The mereotopology remains intact, and treating parts as potential is a matter of situating them in different possible worlds relative to the wholes they are related to. This counterpart-theoretic approach provides a way to deal with modal facts about parts and wholes without departing from standard first-order logic while preserving the existing mereotopological machinery.

4.2.2 Erszat Sums

According to Markosian, there is a distinction between what he terms "metaphysical parts" and "conceptual parts". While the first ones coincide with the usual mereological characterization of parthood, conceptual parts «may or may not be genuine objects, but… correspond to the sub-regions of the region of space occupied by an object, along with the matter, or stuff, that fills those sub-regions» (Markosian, 1998b: 109). Miller & Hariman redefine what Markosian calls "conceptual parts" as "ersatz parts". Their motivation aligns with the pixelist redefinition of part and whole in a way that avoids including sums of pixels in their ontology. By treating parts as abstract entities rather than concrete objects, they provide a strategy for the nihilist commitment that there are no composite objects while still accounting for our ordinary talk of parts:

> Now, let us suppose there is a possible world in which some xs exist, but the *x*s do not compose anything. Suppose, further, that we all talk about this world as if there is a composite object, *y*, composed of the *x*s, and that many of us judge that there is such an object. If one supposes such a world to be possible, how […] are to explain away our resilient intuitions that the *x*s compose something? If you think such a world is possible, then you think these questions require answers.
>
> Miller & Hariman (2017: 525-6).

Employing Miller and Hariman's terminology, for this paraphrastic strategy to succeed, we require a definition of ersatz part whereby, for any object O that exactly occupies region R, there exists no object O* that exactly occupies sub-region R* of R. It follows from this stipulation that there exists no proper metaphysical part of O that exactly occupies R*.[5]

The conceptual strategy underlying this approach posits that when ordinary language users outside the Philosophy Department assert statements such as "the arm is part of the body," they implicitly express that "the arm is an ersatz part of the body." More precisely, such utterances should be interpreted as follows:

> (ERSATZ PART) *C* is an ersatz part of $O =_{df}$ (i) '*O*' is a plural referring expression that refers to the P*x*s, and (ii) the P*x*s jointly occupy region *R*, and (iii) '*C*' is a plural referring expression that refers to some but not all of the P*x*s.

Where "C" is "arm" and "O" is "body", «the "P*x*" picks out any *point-sized piece of matter, portion of stuff, trope,*

[5] They develop four different notions of ersatz part. I am interested in the notion linked to what they term "the eliminative ontic minimalist".

or *property-at-a-location* and the plural referring expression "the P*x*s" picks out some P*x*s»[6]. "Body" functions as a plural referring expression that designates the P*x*s, while "arm" functions as a plural referring expression (not objects) that designates some but not all of the P*x*s[7].

Given this understanding of ersatz parts, we can introduce the notion of an "ersatz sum" as arrangements of P*x*s that we would ordinarily call a composite object. Just as ersatz parts are sets of simples, ersatz sums are sets whose members are themselves simples arranged in particular ways. The ersatz sum is not a concrete object but rather a set-theoretical construction representing the arrangement of simples that would, according to common sense, compose a whole. This approach allows the pixelist to maintain that while nothing composes anything in the concrete world, our talk of composite objects can be understood as referring to abstract entities that represent arrangements of simples. This solution parallels the approach of potential sums, offering the pixelist a way to accommodate ordinary language about composition while maintaining their fundamental ontological commitments.

4.2.3 Parts as Counterparts

Cotnoir proposes that nihilists should instead reinterpret ordinary talk of mereological relations as intensional, holding between objects in different possible worlds. According to his paraphrase, parthood relation is a kind of counterpart relation. As a result, the nihilists are in the same position as the classical mereologist when it comes

[6] Miller & Hariman (2017: 532)

[7] Miller & Hariman assume that such plural referring expressions exist, based on Sider (2007a), Wallace (2011), van Inwagen (1990), McDaniel (2010), and Bohn (2014).

to explaining talk about ordinary objects, but without the additional ontology[8].

He supports this proposal by introducing the concept of "P-arrays" - non-empty sets of spacetime points with specific distributions of instantaneous localized tropes. P-arrays are used to model the external world, abstracting away from the specific material objects that exist. Worlds are then represented as partitions on these P-arrays, where each partition "carves up" the P-array into disjoint regions occupied by material objects. Moreover, Cotnoir assumes a plenitude principle about worlds, where every possible partition on every possible P-array represents a possible world.

In this framework, to propose paraphrases of mereological relations in intensional, interworldly terms, the notions of P-duplication and P-counterparthood are then defined. P-duplicate worlds are those that are partitions on the same P-array, exhibiting the same pattern of trope distribution. P-counterpart objects occupy the same regions in P-duplicate worlds and thus have identical trope distributions and properties. Thus, parthood is reinterpreted as an interworldly relation.

> (PARTHOOD_C): an object x is part of an object y if x occupies a subregion of a world that is a P-duplicate of the world where y is located.

Proper parthood and overlap are also paraphrased using the P-counterpart relation. This strategy allows the nihilist to account for ordinary mereological talk without

[8] Cotnoir's argument is based on the acceptance of heterogeneous extended simples. As Wallace (2013: 214) notes, «[the nihilist] must accept some way of avoiding violations of the Indiscernibility of Identicals. Cotnoir mentions five acceptable ways of doing this, but prefers the Ehring and McDaniel approach, which appeals to unextended, instantaneous localized tropes».

committing to the existence of genuine mereological relations within a world.

4.3 The Fifth-Dimension

Pixelism states that the relation between Leonardo DiCaprio in the morning and Leonardo DiCaprio in the evening[9] is a counterpart relation, as classical exdurantism does. The three approaches to parthood relation in the last section complete the picture by explaining the analogy between radical exdurantism and mereological nihilism. Just as radical exdurantism eliminates the need for temporal parts, substituting that notion with the mereologically neutral one of "stage", those paraphrasis strategies do away with the need for a material parts ontology. So, the nihilist rejection of mereological relations may reconcile with the intuitive appeal of mereological concepts.

Exdurantism and the paraphrasis strategy for mereological nihilism borrow the concept of counterparthood from the metaphysics of modality, as the relation between individuals across possible worlds: the relation between the actual Leonardo Di Caprio and the Leonardo DiCaprio in a possible world in which he is fast-food waiter is a counterpart relation[10]. As Lewis (1986: 232, fn.22) notes, counterparthood, based on qualitative similarity, differs formally from identity as it is not transitive, symmetric, or functional. One object can have multiple

[9] From a pixelist point of view, we should better say "the relation between pixels arranged Leonardo DiCaprio-wise at a certain time in the morning, and pixels arranged Leonardo DiCaprio-wise at a certain time in the evening".
[10] (Lewis 1973, 39–43; 1968; 1986)

counterparts, and different objects might share a counterpart.

The three relations at stake can be considered the same, one with respect to time, the other with respect to possible worlds. *Ergo*, we can add a further coordinate to our model without any conceptual issues. On the contrary, we need a fifth-dimensional model if the spatial, temporal, and modal relations are all counterpart-style relations. The hypercubes and the point models easily allow this move.

Indeed, pixelism can be associated to a five-dimensional metaphysics. Five-dimensionalist holds that objects extend in the modal dimension as well as they do in the temporal and spatial ones[11]. As I have noted in the second chapter, both perdurantism and exdurantism are four-dimensional metaphysics, as the world they describe is four-dimensional. A similar distinction can be drawn also in a five-dimensional metaphysics. In line with the classical definition of endurantism, perdurantism, and exdurantism, we can define two versions of five-dimensionalism:

> (INTERDURANTISM) Entities are five-dimensional aggregates of temporal and modal parts[12].
>
> (TRANSDURANTISM) Entities are world-bound individuals, i.e., present only in a single world.

[11] The seed of five-dimensionalism was planted by Lewis's (1983) postscripts to "Counterpart Theory and Modal Logic". More recently, it has been discussed by Varzi (2001a), Benovsky (2006, part II, ch. 6), Torrengo (2011), Wallace (2014; 2019), Graham (2015), Miller and Duncan (2014).

[12] We can define modal parts as four-dimensional aggregates. In each world, there is a four-dimensional worm, which is a modal part of a five-dimensional aggregate. «Just as a temporally extended object is a sum of temporal parts, a modally extended object is a sum of modal parts.» Graham (2015, 18).

According to interdurantism, entities have modal parts in addition to their spatial parts. If an interdurantist endorses perdurantism (which is its temporal analog), according to her, entities will be five-dimensional aggregates of temporal and modal parts. Such aggregates would extend in the five dimensions by their parts. Transdurantism is Lewis' counterpart theory[13]. It considers entities to be connected across possible worlds by counterpart relations without committing to the existence of trans-world aggregates.

Pixelism is not compatible with interdurantism. In fact, according to pixelism, there are no parts because composition never occurs. There are no trans-world aggregates, just as there are no trans-temporal or spatial aggregates. Nevertheless, pixels extend over five dimensions. If interdurantism is the modal analog of perdurantism, transdurantism is the modal analog of exdurantism, as Sider (2001a, § 5.8) argues. Strictly speaking, transdurantism is the modal analog of radical exdurantism, as a transdurantist does not accept the existence of trans-world aggregates. For this reason, pixelism should endorse transdurantism, *i.e.*, a five-dimensionalism without sums, along with a radical form of exdurantism and mereological nihilism.

4.3.1 Transdurantist hypercubes or points

A transdurantist entity is something that moves along the five coordinates of a five-dimensional space only fictionally. As I have recalled in the previous section, pixels do not compose spatially (given mereological nihilism), temporally (given radical exdurantism) or trans-worldly (given transdurantism). We can explain how this fiction works in the same way we describe exdurantism,

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i.e., by appealing to the motion picture technique. As the dynamic image we see on the screen is an optical illusion created by a series of still images, persistence, spatial composition, and trans-worldly identity of pixels are only fictional.

Following the four-dimensional models in section 4.1.3 and 4.1.4, it is possible to describe two five-dimensional models. Take the four-dimensional hypercubes (*m*, *n*, *p*, *q*). It is described by its four coordinates along the spatial and temporal dimensions. An additional coordinate is needed once we add a further dimension, namely the modal one. Thus, the hypercubes (*m*, *n*, *p*, *q*) in the actual world would be univocally identified as (*m*, *n*, *p*, *q*, *0*). In a different possible world, then there would be a counterpart of (*m*, *n*, *p*, *q*, *0*), univocally identified by the five-coordinate system (*m*, *n*, *p*, *q*, *1*). And the same dialectic can be iterated for the point model.

It is interesting to note that the distinction between the hypercubes and the point models is based on the difference between discrete and continuous spaces. Given that the five coordinates have the same characteristics, the modal dimension may also be discrete or continuous. In the first case, there would be five-dimensional hypercubes; in the second, points in a five-dimensional space. It is difficult to imagine the modal dimension as continuous since we consider the possible world discrete, i.e., there is not "something in between" two possible worlds that is not a possible world itself. This could be a reason to support the hypercubes model as it deals with discrete space.

4.3.2 Fictions, nonetheless

The models I proposed in this chapter reveal that the pixelist solution offers both elegance and coherence in ad-

dressing fundamental metaphysical questions. By treating spatial, temporal, and modal dimensions uniformly, pixelism provides a unified framework where persistence, composition, and modality are explained through the same conceptual apparatus. In a pixel world, nothing persists over more than an instant or exists in more than one world. The pixels, whether conceived as hypercubes or points, are uniquely identified by a five-coordinate system, and their relations across different times, spaces, and worlds are all understood as counterpart relations.

Pixelism offers a single explanatory framework that applies consistently across all dimensions. The complexity of our everyday life emerges from the simple foundation of pixels arranged in a five-dimensional space. Persistence and composition are ultimately fictions — essential to our everyday life, but fictions nonetheless.

Conclusive remarks

In this book, I presented a thesis, namely pixelism, starting from the idea that identity is a general concept. I have suggested that the common idea that identity is a general, absolute, and fundamental relation that pertains to different metaphysical questions and ontological domains leads to a metaphysical position. The generality of identity so described suggests a further thesis: the generality of diachronic identity. If identity over time is a genuine case of identity, then it is reasonable to assume that the generality of identity also spreads to diachronic identity. As a consequence, also diachronic identity can be considered as general. The generality of diachronic identity grants that identity through time is a general relation that equally applies to individuals, groups, and events. For this reason, I have argued that endurantists cannot provide such a unified treatment. My conclusion is that the generality of identity can be held only within a four-dimensional framework.

Following my critique of perdurantism's characterization of temporal part relations, I established the necessity of radical exdurantism for addressing fundamental questions of persistence and temporal change. I defined radical exdurantism as the metaphysical position asserting that entities exist as instantaneous stages without temporal composition into four-dimensional aggregates.

This framework constitutes the temporal counterpart to mereological nihilism, which maintains the impossibility of spatial composition.

Finally, I defined "pixelism" as the synthesis of radical exdurantism and mereological nihilism. Pixelism's worldview consists of a world of single entities, which are combined (both spatially and temporally) only fictionally in our everyday lives. There are no persisting chairs, cats, or skyscrapers, but various combinations of pixels arranged chair-wise, cat-wise, and skyscraper-wise. The temporal dimension is analog to the spatial ones in all respects. It can be efficiently illustrated with a geometrical model in which entities are four-dimensional pixels in a four-dimensional Euclidean space. Moreover, if we add a further dimension, the modal one, we can describe a five-dimensional world in which all the spatial extensions have the same characteristics. The modal analog of mereological nihilism and radical exdurantism is transdurantism. Transdurantism is the version of five-dimensionalism according to which entities are world-bound individuals, i.e., present only in a single world.

Hence, I claimed that a pixelist should embrace transdurantism in order to have a world in which entities have relations along the five dimensions indiscriminately, i.e., a world in which they do not compose spatially, temporally, or modally. Three deep revisionist theses find places in pixelism: (radical) exdurantism, mereological nihilism, and transdurantism (or counterpart theory). All have been criticized on the basis of their incapacity to fit with our commonsensical intuitions. Nevertheless, within a pixelist framework, they strengthen each other. Together, they form a harmonious worldview and can provide a consistent explanation of many metaphysical issues. And, to me, this is a great advantage.

By all means, pixelism is a revisionist thesis. Nonetheless, it is able to provide a robust alternative to commonsense, coherent with respect to persistence, composition, and modality. Why believe in a world of entities with a five-dimensional shape? Because, paraphrasing Lewis (1986, 3), «the hypothesis is serviceable, and that is a reason to think that it is true».

In confronting time with my verticals,
I skirt him with my other lines.

He is my protector,
I go with him, by his side
.
I have, for the duration,
a necessary inclination
and some aptitude.

Parallelepiped

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Identity seems uncomplicated: everything is identical to itself and to nothing else. Yet this formal simplicity has profound metaphysical implications. If identity is absolute and fundamental, applying uniformly across all domains, then its application to time leads to a radical reconception of our world. Through analysis of classical puzzles—from the Ship of Theseus to personal fission—this book develops a five-dimensional ontology called “pixelism,” treating spatial, temporal, and modal dimensions symmetrically. Like pixels on a screen, entities are instantaneous, atomic, and world-bound, connected only through counterpart relations. This yields a coherent view of persistence, composition, and modality—one with no persisting persons, no composite objects, no trans-world individuals, but only fundamental units: pixels configured chair-wise, person-wise, or universe-wise.

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