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Individuation

Since at least the time of Aristotle, philosophers have debated what it is that constitutes an individual person or thing. What makes it a unity, numerically one? What distinguishes it from everything else?

Individuation is related to the metaphysical problems of constitution, composition, colocation, essentialism, and identity.

Given two equal amounts of matter, they are distinguished by their shape or form. Given two things with identical form, they are individuated by being embodied in different material.

The History of Individuation

It was the general opinion of scholars for many centuries that Aristotle claimed that matter (*hyle*) is what individuates a form or essence. Aristotle was openly skeptical about the independent existence of his mentor Plato's Ideas in the Theory of Forms (*eidoi*). But many commentators in the past several decades have shown that Aristotle ultimately came around to believe that an *immaterial* Parmenidean "being" or "essence" (*einai*) is also involved.¹

Although a few scholars argue for form *instead of* matter, information philosophy and modern biology show that both form ("information") and matter ("stuff") are always needed.

In his metaphysics, Aristotle sought to understand "being *qua* being." Can there be a form without matter? Surely form without matter is empty and invisible, merely conceivable. Matter without form is impossible, but if some material is merely formless or shapeless, it contains no valuable information.

Information philosophy notes that information is neither matter nor energy, though it needs matter to be embodied and energy to be communicated. Unlike matter-energy, information can be created and destroyed. The material universe creates it by rearranging the material. The biological world creates it and

¹ Lukasiewicz, Anscombe and Popper (1953), Lloyd (1970), Regis (1976), Cohen (1984), Whiting (1986).



utilizes it. Above all, human minds create, process, and preserve information, the sum of human knowledge that distinguishes humanity from all other biological species and that provides the extraordinary power humans have over our planet.

Information is the modern spirit, the ghost in the machine, the mind in the body. It is the soul, and when we die, it is our information that perishes. The matter remains.

Aristotle's speculations about the mother (*mater*) providing formless matter for a child and the father (*pater*) providing the form (*pattern*) in his seed (*σπερμα*) show that Aristotle knew both matter and form are needed to create an individual. At *Metaphysics* 1033b, he says, everything must "be partly one thing and partly another; I mean partly matter (*hyle*) and partly form (*eidos*)."

It is tempting to associate matter with Aristotle's material cause and form with his formal cause. We know he sometimes claimed one and sometimes the other as individuating, but everything consists of both.

At *Metaphysics* 1034a, Aristotle says Callias and Socrates are identical in form (man), but different because their matter is different. But at *Metaphysics* 1041b 8, he says, "Thus what we seek is the cause (i.e., the form) in virtue of which the matter is a definite thing; and this is the substance (*ousia*) of a thing.

Ancient religions described *immaterial* souls coming to earth to become embodied as material individuals. Did they bring a personal identity with them? Scholastics argued that all angels, who are not material, cannot be easily differentiated. They could all be collocated in the same place at the same time, on the head of a pin, for example.

Was Socrates' soul, before his instantiation in material, already Socrates? We have clear evidence that some Greeks thought not. Others wanted the immortal soul of Socrates to survive death. Consider this passage from Stobaeus:

So too in general when it comes to substance, to hold that we are the same as our substances seems unconvincing. For it often comes about that the substance exists before something's generation, before Socrates' generation, say, when Socrates



does not yet exist, and that after Socrates' destruction the substance remains although he no longer exists.²

Aristotle, though he was critical of the Platonic forms (*eidōs* or ideas), noted the importance of form as completing the individual. He notoriously used the term we usually translate as “substance” (*ousia*) in conflicting ways, sometimes talking of form as an essence (*einai* or being) and as a “primary substance,” (*proten ousian*) for example,

by “form” I mean the essence of each thing, and its primary substance

εἶδος δὲ λέγω τὸ τί ἦν εἶναι ἐκάστου καὶ τὴν πρώτην οὐσίαν³

Stoics, like Chrysippus, argued that matter is the basic “underlying substrate” (*υποκειμενον*). That which identifies a “peculiarly qualified individual” (*ιδιοσ ποιον*) is a unique bundle of qualities or properties that come with the *pneuma*, a combination of air and fire that is approximately the earlier Greek soul (*psyche*).

Academic Skeptics mocked the Stoics as seeing two things as “colocated,” occupying the same place at the same time. The paradox of the lump of clay and the statue was a prominent example. This puzzle can be resolved by noticing that the two things are simply matter and form, which are always colocated even if a particular form might appear to be “formless.”

The Roman philosopher Boethius said in his *Isagoge* that numerically distinct individuals differ only in accidental properties.

Ea vero quae individuae sunt et solo numero discrepant, solis accidentibus distant

The early medieval philosopher AVICENNA (*Ibn Sinna*) used the concept of a “determinate individual” which suggests the Stoic concept of “peculiar qualifications,” but it was translated into Latin as *signatum*, which suggest an entity with a name.

The later AVERROES (*Ibn Rushd*) compared individuation to the process where a sculptor creates a statue from the otherwise indeterminate shape of a block of marble.

2 Stobaeus *The Hellenistic Philosophers*, Long and Sedley, v.1, p.168

3 Aristotle. *Metaphysics*, VII, vii, 1032b



The scholastic discussions of individuation by THOMAS AQUINAS followed Aristotle, making matter the principle of individuation, but he deliberated between Averroes and Avicenna. He first supported Averroes and his *signatum*, understood as the acquisition by matter of determinate dimensions. But later Aquinas also accepted Avicenna's arguments about dimensions, which today we might see as an emphasis on the form.

JOHN DUNS SCOTUS had a distinctly empiricist attitude compared to the rationalism of his older contemporary Aquinas. From two material things with identical form, a universal can be abstracted that he called *quiddity* or "whatness." Any aspects of a thing that makes it particular, he called *haecceity*, its "thisness."

WILLIAM OF OCCAM was a nominalist who regarded the question of individuation meaningless, since for him individual things were the only reality. Ideas like species were only concepts in minds.

The principle of individuation of the last great Scholastic, FRANCISCO SUÁREZ, included both matter and form, the *total* of information in an entity, as we would say in information philosophy.

The Process of Individuation

Given one lump of undifferentiated matter, breaking it in two by sculpting it into distinct forms, would appear to create two individuals. In this case, form would appear to be the operating principle of individuation.

Like most problems in metaphysics, individuation has been analyzed and debated with close attention to words and concepts.

Information philosophy identifies abstract immaterial form as the information needed to specify exactly how to create an identical copy of a thing. In standard usage, the word form refers to an outer two-dimensional surface, that part of something that is most easily perceived. But information philosophy also needs information about the internal material parts - the elementary particles, the atoms, the molecules, etc., their instantaneous positions over time, their interactions with each other, and, in the case of living things, the communications of their component parts with one another and with other beings.



For *abstract entities* that contain no material substance, we can ask what could individuate them - two circles with the same radius, for example. If they are located at different places in space, that would work. But does this require their material embodiment, as ink on paper, for example?

What about a circle that is in a single place, should we distinguish its temporal parts diachronically and ask whether the circle at $t=0$ is the same circle at $t=1$? This is a metaphysical problem known as persistence.⁴

The Biology of Individuation

Although metaphysicians rarely look to what is going on scientifically, a metaphysicist looks at the powerful connection between matter and its embodied information that explains a biological individual.

For example, we now know that every organism, even the simplest single-cell bacteria, archaea, and eukaryotes are unique individuals.

From the very earliest proto-life forms that could duplicate themselves, only some duplicates were exact replicas. As JACQUES MONOD pointed out, perfect reproductive invariance would proliferate a species, but without a modest number of random variations, there would be no evolution.

Perfect copies would be identical, differing only in their physical locations. A variation in their information content produces two intrinsically different individuals.

The most complex organisms, eukaryotic cells and multicellular organisms, use the deliberate randomization of chromosomes in sexual reproduction to produce essential variety in the gene pool. Even when a cell divides to produce two individuals that are genetically alike, the development process introduces variations that are not inheritable, but that ensure adults are unique individuals, because their information content differs.

4 See chapter 18.



The *principle of individuation* in biology is a combination of genetic and epigenetic differences in the information content of individuals. It is the form that differentiates them, not the specific material they are made of. We are different individuals because of chance events, from our first zygote stage to our last breath, that change our information content. Here the change is growth and decline, with a high degree of preservation of the vital information. In higher organisms, what is preserved is learned information - recordings of experiences.

The material content of any organism also is in a state of continuous change, as food (matter with low entropy and high free energy) moves through an organism. It is the comparatively stable, but constantly growing, information content embodied in the material that we recognize as the essence of an organism.

Very few cells in a multicellular organism have lifetimes close to the life on an individual. In humans, some neurons and egg cells that do not reproduce can last a lifetime, sperm cells last only a few days, skin cells a few weeks, red blood cells a few months, and white blood cells a year or so. The stem cells that form new blood cells and form the rapidly shed epithelial cells in skin and the gastrointestinal tract can themselves last a lifetime.

On average, all the material at the atomic and molecular level in a human body is replaced every seven or eight years, yet we persist as the same person over our lifetime. What philosophers of mind describe as the continuity of memory or consciousness, information philosophy sees as the stored information in the ERR (experience recorder and reproducer).

Individuation and Quantum Mechanics

We saw in the last chapter that no two distinct things can have the perfect identity that made the question of individuation so serious a problem for the ancients.

But it turns out that modern physics has discovered properties of elementary particles that again raise what appear to be metaphysical questions about what we can regard as individuals.



Specifically, quantum physics finds that two particles (electrons, for example) can be so identical that we cannot tell which is which. They are “indistinguishable” in a way that affects their statistical properties.

They are loosely called “identical particles,” but this contradicts our notion of “self-identity.” “Two” classical particles that are “self-identical” must be just one particle.

All electrons are indistinguishable and identical in the sense that interchanging them does not create a new quantum state. In classical statistical mechanics, we count the number of possible distributions of the system as the number of ways that we can arrange the particles, the ways we can distribute them among volumes in phase space, a combination of ordinary configuration space and momentum space.

If we have two particles 1 and 2 and two volumes a and b, with distinguishable particles, we have two states we can call ab and ba. With indistinguishable elementary particles, in quantum mechanics these are counted as just one quantum state, giving rise to what are called Bose-Einstein statistics and Fermi-Dirac statistics.

What we called the extrinsic or relational properties of objects become very puzzling, because we cannot say that one quantum particle is “here” and the other “there.” Either particle may be found anywhere the value of the probability amplitude is non-zero.

The intuitive metaphysics of individuation apparently does not apply in the microscopic quantum world, as was first discovered by ALBERT EINSTEIN in 1924, just one of the many non-intuitive aspects of quantum mechanics that he discovered.

