Why There Are Three Spatial Dimensions
(added Aug., 2013)

Fundamentally, the dimensionality of spacetime is a matter of energy conservation: three dimensions are sufficient to establish an entropic domain in which the basic thermodynamic requirements necessary to conserve the energy of free forms of electromagnetic energy (light, EM radiation, etc.) are present; likewise, four dimensions are necessary to meet the conservation requirements of bound forms of electromagnetic energy (mass/matter).

Light is a 2-D transverse wave, with no time dimension and no space dimension in the direction of motion (clocks stop and meter sticks shrink to nothing at velocity c - as per Einstein). Light requires two dimensions to accommodate its alternating electric and magnetic fields, which induce each other at right angles. The energy of light is encoded in its frequency (E = *hv*) with its implied (but suppressed) time dimension. The intrinsic motion of light ("velocity c") "sweeps out" a third spatial dimension, creating, expanding, and cooling a 3-D spatial volume. The energy component of light is therefore 2-dimensional, while the entropy component corresponds to the 3rd spatial dimension. The entropy "drive" of light (free electromagnetic radiation) is the "intrinsic motion" of light, as gauged by the universal electromagnetic constant "c".

We see that three dimensions are sufficient for 2-D light to establish an entropy domain for its own conservation needs, and therefore light has no need to explore additional dimensional possibilities. Similarly, in the case of 3-D bound energy forms of electromagnetic energy (massive atomic "solids"), one further dimension (time) must be added to establish the entropy domain for matter (history), in which the "intrinsic motion" of time produces aging and decay (since atoms have no spatial form of intrinsic motion they must resort to time - which also suggests that the 3rd spatial dimension is the only possible higher-dimensional entropic option for light - if it is to remain in its free form). Gravity combines these two electromagnetic entropy domains into our familiar spacetime, the composite entropy domain of our universe of free and bound forms of electromagnetic energy. (See: "The Conversion of Space to Time" .)

In the "black hole", the electromagnetic metric of light and space (as gauged by the universal electromagnetic constant "c") is completely overwhelmed and replaced by the gravitational metric of matter and time (as gauged by the universal gravitational constant "G"). The energy of the black hole is encoded in its mass (*hv* = mcc), while the entropy is encoded in the two-dimensional "event horizon" (as per Bekenstein and Hawking - see: *Scientific American* Aug. 2003 pp. 58 - 65.) The entropy drive of matter and the black hole is the "intrinsic motion" of matter's time dimension, which creates the spatial flow of matter's gravitational field. *A gravitational field is the spatial consequence of the intrinsic motion of time*. The expansion of the black hole's "event horizon" is required (when energy is added to the hole) since the gravitational intensity and material density of the hole is already at a maximum (g = c); therefore the only way to increase the gravitational flow (which is necessary to increase the temporal entropy encoding for the added energy) is to increase the *size* of the gravitating mass, in other words, increase the boundary or surface area of the event horizon, which is the only part of the hole in active/actual contact with the outside spatial universe. If the black hole has a 3-dimensional "volume" at all, it is permanently hidden behind the event horizon, which is in fact a temporal entropy surface (see: "A Description of Gravity"). Hence the extreme temporal/gravitational /material metric suppresses space just as the extreme spatial/electromagnetic/light metric suppresses time.

Information is encoded in our ordinary universe in all four dimensions. Information requires the one-way 4th dimension (time) for its entropy drive and for its historical conservation domain, due to the causal characteristic of information. Because the black hole either destroys, suppresses, or hides both the third and 4th dimensions, (time stands still at the event horizon and meter sticks shrink to nothing), the black hole contains almost no information, or as John Wheeler says: "A black hole has no hair". Information may live forever in the historical domain, but not in the black hole. Hawking should have stuck to his guns. (See: Leonard Susskind: "*The Black Hole War*"; Back Bay Books, Little, Brown and Co., 2008.)

The energy and entropy of information are encoded in the black hole's mass and the surface area of its event horizon. The causal component of information ceases to form new linkages upon entering the black hole and inside the event horizon distinguishable atoms are converted to "anonymous" photons. Causal linkages created by information outside the black hole, however, continue to propagate forever in historic spacetime. Entangled elements swallowed by the black hole are moot, since they remain hidden forever, suspended or "frozen" in time at the event horizon.

Information is one-way (asymmetric) due to causality, as well as due to the absence of antimatter ("anti-information");
Gravity is one-way and asymmetric;
Time is one-way and asymmetric;
Entropy is one-way and asymmetric;
Matter is asymmetric - due to its time dimension, gravitational field, lack of intrinsic motion, mass, and lack of an antimatter complement.

The black hole is the extreme case of the gravitational metric, as gauged by the universal gravitational constant "G". The black hole is the ultimate contrast to a universe of light with no matter at all, the extreme case of the electromagnetic metric, as gauged by the universal electromagnetic constant "c". In the light universe, all forms of energy move at velocity "c', time does not exist, nor does space (in the direction of a photon's motion). In the black hole also, all forms of energy move at velocity c, and space and time are absent. In this comparison, we see "velocity c" acting in both cases as the "gauge" of a symmetric energy state - specifically, a state of non-locality either outside or inside the black hole. In the light universe, photons and their energy content are distributed equitably everywhere, simultaneously - since there is no time parameter and no distance parameter (clocks stop and meter sticks shrink to nothing in the direction of motion at "velocity c"). This same "non-local" symmetric state with regard to the distribution of energy is achieved by the black hole *within* the boundary of its "event horizon" - again because all forms of energy move at velocity c, time has stopped and space has vanished, due to the action of a gravitational field whose strength is locally equivalent to the electromagnetic constant "c" (g = c). Clocks stop and meter sticks shrink to nothing at the "event horizon" of a black hole.

This discussion suggests that the conservation role of gravity is to pay the "location" symmetry debt of matter. The "location" symmetry debt/charge arises in consideration of the spatially undistributed (hence asymmetric) local concentration of immobile bound energy (matter), VS the spatially symmetric "non-local" distribution of light's energy (due to light's intrinsic motion "c"). Because matter is originally formed from light (bound electromagnetic energy is originally formed from free electromagnetic energy), matter carries a gravitational "location" charge, among other symmetry debts in the form of charges and spin, due to matter's formation from all-symmetric light. (See: "Symmetry Principles of the Unified Field Theory".) The gravitational "location" charge is unique in that it represents an entropy debt as well as a symmetry debt. Because the intrinsic motion of light is both the entropy drive of light and the cause of light's non-local distributional symmetry, the gravitational "location" charge must conserve both functions if it conserves either one. (See: "The Double Conservation Role of Gravitation".) Gravity pays matter's "location" symmetry debt by creating black holes, in which "Hawking Radiation" converts (eventually) the entire bound energy (mass) of the black hole back to free energy (light).

Along the gravitational pathway leading to the creation of black holes, bound energy is also converted to free energy via the nucleosynthetic pathway of stars, and by the even more efficient conversion of gravitational energy and mass to light in other astrophysical processes such as supernovas and quasars. But once the black hole condition is reached, conversions of bound to free energy (in any appreciable quantity) essentially stop (so far as we know), if only because gravity prevents the escape of any light produced by such processes, should any occur. In the event horizon, gravity creates a temporal metric for matter which is the symmetric equivalent of the spatial metric of light - a metric in which all forms of energy move with intrinsic motion c. What happens in the interior of the black hole is moot, since we can never know. I suspect, however, that proton decay occurs at the singularity, and hence the black hole is filled only with light - another way in which the gravitational "location" symmetry debt is paid, also solving the problem of the infinite compressibility of matter. But nothing else matters once the event horizon is formed (at $g = c$); a symmetric temporal metric has been constructed in which all energy forms travel at c, and it would appear that no further conservation concerns need be addressed. But is this really the final word?

What then of "Hawking Radiation"? We note, of course, that Hawking radiation is pitifully small for any large hole, and tellingly, it gets smaller as the hole grows larger, not an encouraging sign for the cause of symmetry conservation at least via this route, since the natural tendency of the black hole is to forever increase in size, which means this symmetry conservation pathway is asymptotically suppressed in the natural course of events. However, if the interior of the black hole is indeed filled only with light, then some photons may escape the event horizon by quantum mechanical "tunneling", and this process might *increase* with the size of the hole, counteracting the decrease in Hawking radiation. Whatever the case, the amount of time available for this process (in a universe that does not collapse) is essentially unlimited (assuming that other, unknown cosmological processes do not intervene), so in the end the hole will completely evaporate its mass to light: bound, asymmetric electromagnetic energy returns to free, symmetric electromagnetic energy. One rationale for this scenario is that the temporal entropic metric of the black hole event horizon is less symmetric (being one-way) than the "all-way" spatial entropic metric of light, driving the eventual and final conversion of mass to light in complete satisfaction of Noether's Theorem. Nevertheless, the time required for this conversion to go to completion is so immense that it suggests Natural Law is in fact rather comfortable with this arrangement - the temporal metric of the black hole is stable, leaving little to be desired either inside or outside the event horizon in terms of conservation issues. This is another reason for suspecting that the interior of the black hole is filled with nothing but light, rather like a superconducting medium in which photons have become heavy.

All this notwithstanding, a major conservation issue remains unresolved, as attested by the continuing presence in the surrounding universe of the black hole's powerful gravitational field, even after the event horizon has formed. So long as this field is present, the symmetry debt it encodes and represents remains unpaid. One reason that gravity keeps working even after the formation of the event horizon is that matter's entropy debt must keep being paid until matter's symmetry debt is completely paid, and as far as the outside universe is concerned, the black hole still represents a grossly asymmetric concentration of undistributed, immobile mass-energy, a severe affront to symmetry conservation in terms of the equitable dispersion of energy throughout space - as was originally the case for the light from which the black hole's matter was produced. The gravitational entropy debt of matter can be thought of as an "interest" payment on matter's symmetry debt - just as on planet Earth, the interest has to be paid until the symmetry debt is retired. But the Earth's gravitational field is too weak to convert mass to light, so it never "pays down" the principle on its symmetry debt - that is, despite the continuous working of Earth's gravitational field, it never gets weaker because it never converts any of Earth's mass to light. In our Sun, however, we see gravity actually "paying down" the symmetry debt of the Sun's mass by converting some of the Sun's bound energy to light, and hence reducing the Sun's total mass and its associated gravitational field. Gravity will vanish completely when its symmetry debt is well and truly paid, like any other charge (see: "Does Light Produce a Gravitational Field?"). So the black hole's gravitational field keeps working until the mass energy of the hole - whose entropy is represented by the surface area of the event horizon - completely evaporates away.

Since it is the surface area of the event horizon which is in contact with the outside universe, it is the surface area which generates the gravitational field. Hence the connection between time, gravity, and entropy is especially evident in this example. *A gravitational field is the spatial consequence of the intrinsic motion of time* (see: "The Conversion of Space to Time"). (See also: "The Destruction of Information".)