Power, a Philosophical Analysis

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I always love coming to ISPCS. It's one of my favorite events of the year. I've done a lot of talks here, several panels and one memorable lunchtime keynote on the patio in the howling wind. Most of the time, I have talked about some issue in space policy or the goings on at ULA, and this year many of you are probably interested in our work with Boeing on commercial crew or our new partnership with Blue Origin. But you'll have to catch me later on any of that.

This year, my talk is completely different and far more personal. You see, I have a passion for philosophy. Last year I published a book, called The Philosophy for the Future, and sent a courtesy copy to Pat Hynes. It never occurred to me that she would actually read it. But she did and asked me to give this talk. It happens that one of the central themes of my book is power and "the power of 10" is the theme of this conference. (This being the 10th year of the conference.)

The concept of power occurs in my book on several levels. It is a unifying concept in the description of human psychology and sociology. It is also a normative concept, something to be aspired to, a goal.

On the descriptive side, Bertrand Russell, an English philosopher and logician, wrote "The fundamental concept in social science is power, in the same sense that Energy is a fundamental concept in physics."

Friedrich Nietzsche, one of my favorite philosophers, viewed power—more precisely, the will to power— as the unifying concept in psychology. Nietzsche believed the will to power imbues all living things. "Where I found the living, there I found will to power."

Digging a little deeper, and perhaps getting a bit more pedantic, the sociology literature distinguishes between power-to, which I think of as capability, and power-over, in which one person has power over another, like a tyrant. Power-over when taken to an extreme can be evil. "Absolute power corrupts absolutely," is the saying and we see examples of that throughout history and in the world today.

The concept of power I wish to focus on is power-to, and that is the concept that is the theme of the conference. Power to do; power to achieve; power to accomplish great things; power to make of ourselves what we will. This concept is affirming and supremely inspirational.

Now let me get even more pedantic and torture you with a formal definition of power-to. I conceived of this definition some 20 years ago while sitting in my cubical as a youngish engineer at Lockheed Martin. (My boss probably thought I was doing rocket science…) I was looking to quantify power in such a way as to be used as the utility function in a formal decision theory. This means that power should be quantifiable as a number and applicable to an agent. An agent is a fancy philosophical word for a decision maker who acts to achieve some goal. You are all agents.

So, per my definition, the power of an agent is the maximum difference in possible future states of the world achievable through potential courses of action available to the agent. Here it is written in symbols.

$$\Omega = \max_{i,j} |S_i - S_j|,$$

where $S_{i,j}$ are future states of world resulting from courses of action i, j available to the agent.

Let me illustrate with a few examples. Imagine being held in a prison cell for the rest of your life with no means to communicate or affect the outside world. Every possible course of action available to you—and there are precious few— leads to exactly the same future. If each future is the same, the term inside the absolute value bars is zero and your power is zero; you are utterly powerless.

Now let's look at the other extreme. Suppose you wandered into the mountains north of here after becoming bored with the presentations and came across an alien artifact that contained plans for anti-gravity and warp drives. (That's not so farfetched. We are in New Mexico after all.) Now you have a choice. You could destroy the artifact in which case the future state of the world would be as if the artifact had never existed. Or you could use the artifact to create marvelous capability to allow humankind to rapidly expand into the galaxy and beyond. We'd all like to write the business plan for that! Anyway, two very different futures, and per the definition, your power would be enormous.

Based on this definition of the power of an individual agent, we can define the power of a group. And what you will find is that the power of a group increases exponentially with group membership based on the possibility of cooperation. Agents who cooperate to achieve a mutual goal are capable of so much more than any individual acting alone. We all know this intuitively, but the mathematics of power shows it explicitly. From here we can talk about the power of societies and nations. And ultimately of humankind as a species.

We can also talk about different flavors of power obtained by restricting our definition to certain kinds of future effects or capabilities. For example, physical power is the ability to affect the physical state of the world. This is the power of the engineer. Roads, buildings, cars, planes, rockets, spacecraft and iphones are manifestations of physical power.

Technology is its currency. We can talk about economic power and political power and military power.

Recall Bertrand Russell's analogy. We in the space business understand how different forms of energy can be converted into each other. Chemical energy from propellants is converted into kinetic and gravitational potential energy of a satellite in orbit. In a similar way, different kinds of power can also be converted into one another. Economic power can be converted into physical power by investing in technology. Physical power can lead to military power through the creation of weapon systems. Economic power can lead to political power through lobbying or contributions or bribes. You get the idea.

Another interesting kind of power is what I call scientific power. It is a mixture of explanatory power and predictive power. It is a property of one's worldview. Without going into detail, let me just claim that scientific power can be converted to physical power through the creation of technology.

So with this understanding of the concept of power, let me now make the rather bold claim that the *will to power* has been and remains one of the driving forces in human history. The will is manifest at both the individual and group levels. That is, each human seeks as part of his or her basic nature to increase his or her personal power, and that human groups seek to increase their collective group power. These dual drives lead to the central tension in human nature, between individualism and collectivism. In my book, I go into detail about the evolutionary origin of these drives, and how they are linked to the forces that drove the evolution of intelligence.

But now I want to shift gears and talk about power as a normative concept. Philosophers have made a great deal of the distinction between descriptive language, or the recounting of facts, and normative language, or the stating of goals or ideals or values. The famous naturalistic fallacy is conflating the way the world *is* with the way it *ought* to be. In logic, it's what's called a category error.

The bottom line is that to bridge the gap between science (which describes what the world is and how it works), and ethics or policy making (which provides ideals or norms about how the world ought to be or how we ought to act), we need an additional ingredient. What we need is another premise, an axiom to the mathematicians. What we need is an overarching goal.

My proposal for the overarching goal of humankind is "long term viability of the species." In other words, we should try to avoid extinction. I view this goal as being self evident. It's not necessarily the only objective, but it's certainly foundational.

OK, let's take the next step. It is my claim that maximizing long term species power (as I have just defined it) is the best means—the optimum means—to achieve the long term

viability of the species. In my book I give a lengthy and, in my opinion, a fairly compelling justification for this claim. But here let me describe a thought experiment that gives you an intuitive feel for it.

Imagine an immense Monte Carlo simulation where innumerable futures are played out. In some of those futures a killer asteroid strikes, or an advanced alien civilization is encountered. In others catastrophic climate change occurs or terrorists gain nuclear weapons or a genetically engineered plague is loosed. Now think what policy, if adopted globally, will lead to the greatest statistical occurrence of long term viability. It is species power, pure and simple. The ability to detect and repel an asteroid; the ability to survive an encounter with a potentially hostile alien race; the ability to control the climate; the ability to provide global security; the ability to control and defeat pathogens. These are the keys to long term success.

Now we have established power as the ultimate goal. And with the quantitative definition I provided, we can construct a decision theory based on power as the utility function. I won't go there, and it's explained in the book in depth, but you can construct a very satisfying ethical theory based on power as the utility. In other words, power underpins—it justifies—all morality.

But I want to move beyond ethics into the realm of broad policy making. I recognize there is much room for debate on this topic, but with maximizing power as the overarching goal, I've identified three elements of a plan to move humanity into the future. First is global political unification. This might irritate some of the more nationalistic among you, but the logic is unassailable. The cooperative power of a unified humanity would be astounding. Imagine the enormous benefits of global security and unleashing the cooperative potential of all seven billion individuals. Imagine if the resources we now spend around the world on military endeavors and geo-political conflict could be redirected into goals that benefit all such as scientific research or technology development or expanding human presence into space. Just imagine.

This gets me to part two of the plan: enhanced science and technology. It should be obvious by now, but increasing overall scientific understanding—scientific power—directly increases species power. There are a number of technology areas that hold great promise in the modern world. They go by the acronym GRIN: G for genetic or biotechnology, R for robotics, I for information technology and N for nano-technology. Advances in all of these should be pursued with great vigor.

The third part of the plan is human expansion into space. In the book, I lay out several arguments as to why this should be our objective which I won't get into here. But in essence, if the overarching goal of humanity is to increase our power as a species, then expansion into space is an obvious and vital means toward that end.

This brings me to a final point and a connecting of the concept of power as I've described it and power as defined by a physicist and measured in Watts (or the rate of energy delivered). In a 1964 article in the journal Soviet Astronomy, Nikolai Kardashev defined a scale to measure the level of advancement of a civilization. It was generalized somewhat by Carl Sagan, another one of my heroes, and it reads like this:

$$K = (\log_{10} W - 6)/10,$$

where W is the civilization's power output in Watts.

The Kardashev number of a civilization is basically the log of the power output of the civilization with appropriate scaling factors. To align a bit better with my definition, I like to think of it as the power controllable by the civilization.

With that definition in mind, a type I civilization can control its planet. A type II civilization can control its solar system. A type III civilization can control its galaxy and type IV is in control of the known universe. Humans are currently around 0.7.

So based on all this, our goal should be to ascend this ladder from 0.7 to one to two and beyond. And to this end, deriving economic benefit from space is essential. It's the key to making the space enterprise self-sustaining. And the key to deriving economic benefit from space is commercialization. In other words, the commercialization of space is essential for the sustainability of the space enterprise and thus essential for the long term viability of our species.

And that is why we are all here. That is why we've been coming to this remote corner of the dessert for the last ten years. And *that* is the power of 10.

Thank you and I think I have time for a few questions.