A Few Portal Technology Application Ideas

By: Paul Spooner, 10-11-2007

Short Introduction

Dear Mr. Newell (or whoever ends up reading this),

I don't know what you all have thought about in regards to the scope of portal technology. I suspect you've thought about quite a lot. What follows covers my thoughts on how portals could be used, both in a "real world" setting, and in a game. I apologize in advance if I explain in detail what may appear obvious. My intention is to be helpful, not condescending.

With that said, I really loved Portal! I hope these few notes are helpful.

Technical Applications

This section goes over several ways in which the unique properties of an intra-dimensional portal can be exploited. They are all theoretically sound, though some may be un-suitable for use in a game.

Free Kinetic Energy

The basic way in which portal technology is used in Portal is to move matter from place to place. Apart from conquering distance and re-directing energy balls, the obvious direction to go is straight down, the infinite elevator shaft. This makes use of the earth's gravity to get free kinetic energy. In Portal you mostly just fling yourself about with it, but this kinetic energy could be used in several ways.

Try placing a magnet in a vertical tube and coiling wire around the tube. With the portals added it becomes a linear generator! Strap some mass to the magnet and evacuate the air. Now the generator will charge up kinetic energy when there is no power being used.

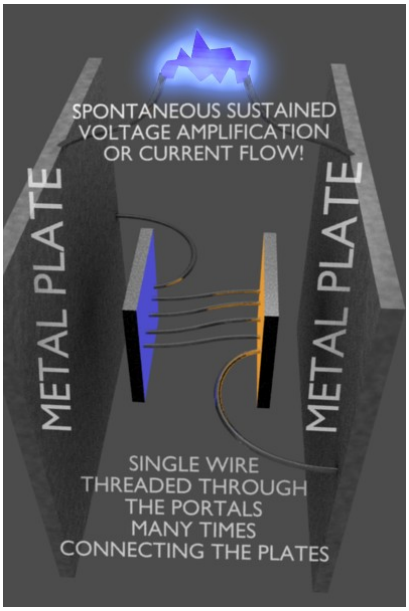
A more military application is the kinetic energy weapon. Evacuate the tube and throw some long rods into it (or ball bearings, old washing-machines, whatever). With the air resistance gone any object in the tube will reach fantastic speeds. In just eight hours it will have exceeded 9/10 of the speed of light! Redirect it through a portal for a nuclear-style explosion. You could launch stuff into space this way too. Of course, once you launched a portal (or the associated generator) into space you wouldn't need to launch anything else.

The falling column technique could also be used to blue shift lasers and increase the photon energy (or the reverse, if desired). It wouldn't be very practical at earth gravity, since to blue shift light from 650nm to 450nm (red to blue) would take almost half a year, but at higher gravities it could become practical, especially if portals could be placed on the surface of a neutron star.

Of course, pressure differentials can also be used. Place a portal at the bottom of a tank of fluid and you can make waterfalls, rivers or fountains. Fluid use is explored more thoroughly in the “game-play applications” section.

Free Electrical Energy

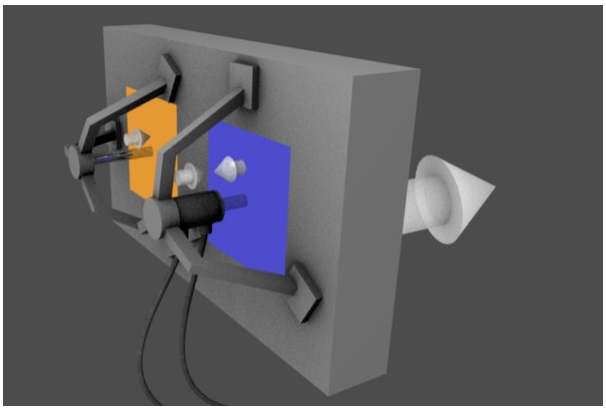
The most basic and useful application of portal technology is the generation of practically limitless amounts of electricity. Any parallel portal loop in an aligned electrical field (such as exists between two oppositely charged plates) would immediately become a steady state voltage amplifier. Hook the wires up to the charged plates (make a feedback loop from the amplifier) and you get spontaneously increasing voltage. This would eventually lead to a huge electrical arc through the portals and a meltdown, but a throttling arc-gap could be employed to limit the voltage. Make as many loops as required for your expected voltage needs, and make the wire thick enough to handle the current draw. You now have free steady state electricity, for as long as the portals stay open.



The amplifier takes advantage of the fact that charged particles flow toward the opposite charge. A positively charged plate will attract electrons, while a negatively charged plate will repel them. Normally this isn’t too useful, but with portals a virtual infinite field can exist, with the wire carrying the electrons happily toward the positive (and away from the negative) plate, without ever reaching it. This amplifies the voltage on the plates depending on how many times the wire is looped through, and at no cost. With a high enough charge on the plates an endless arc could be created in the portals, doing away with the wire entirely.

By connecting the output wires to the plates as shown, a feedback loop is created. As the voltage gets higher, the driving charge gets higher too, until something begins to dissipate the charge. An emergency arc-gap is a good solution. Any piece of equipment would work in theory, but if it ever stopped drawing current the voltage would quickly skyrocket and something would explode.

Free Constant Force



By re-directing objects, portals also redirect the forces acting on them. If the portals can be maintained on mobile objects then a reaction-less drive could be easily set up. Place a pair of portals on the object to be moved, facing the same direction. Make a frame over each portal and connect the frames through the portal with something. A bolt would work, or a hydraulic cylinder, or just reaching through and grabbing the frame. When you pull on it (tighten the nut, or retract the cylinder) both the force and the reaction force act on the object in the same direction, pushing it forward. Flying cars (or even cities) with this kind of drive would be common and cheap. As long as the portals stay open and the tension persists, the drive will continue. The effect can be reversed of course, to pull the object instead of pushing it. A magnet could be substituted for a mechanical linkage, or an "insubstantial beam of light." As long as it exerts normal force, the portals can turn it into reaction-less force.

Help! I'm Getting Crushed by the Universe!

If portals can move in relation to each other then any object caught between converging linked portals would be crushed against itself irresistibly. This effect requires no force on the part of the object on which the portals are mounted. To any object between the portals, the universe grows thinner and thinner. Eventually, as the portals converge, everything between them will be mashed out the sides, possibly with great velocity, heat, and noise. What good this would do I can't say. It sounds painful though.

Tearing objects apart would work too. If it forms a loop through the portals, that loop can be pulled apart by moving the portals apart. No force is required.

Discombobulated Machines

(animals too!)

Portals bring far things close together. This also means that things which need to be close can be far apart. Machines working through portals could be a real boon for manufacturing. If the machines can carry the portals with them then a small mobile robot could carry a portal with it, which opens to a whole machine shop or factory. Machines, houses, weapons, vehicles, or anything else could be assembled or maintenance on site. All kinds of local machines could be centralized. For example, central heating would take on a new meaning, where one unit could easily service thousands or millions of homes. At some point this would affect the society, and the world drifts into space opera science fiction. One result is that humans could carry small portals inside them, while

crucial organs are left in a safe place. One the event of bodily destruction, the portals would redirect to a new body and life goes on as usual.

Game-Play Applications

So, how do these strange ways of using portals fit into a game? Here are some thoughts.

Desired Limitations

It seems unlikely that you would wish all of these exotic applications to occur in the setting of the game. Therefore limitations of some kind could be established. Obviously you have made several of these explicit already in Portal. Here are a few ideas.

- Portals can only be opened on existing material surfaces (possibly with very limiting properties, or rare materials)
- Distance between portal openings is limited. No interstellar travel; No instant orbital door; Perhaps not even a pantry with the grocery store inside.
- Portals can only exist on 'stationary' objects (the earth is spinning, so how this one works may be arbitrary). This eliminates the reaction-less drive, and many discombobulated machines.
- Portals will collapse if the move relative to each other (two portals on a rigid structure will persist, even if the structure moves). This eliminates the 'crushed by the universe' phenomenon.
- Portals are of a limited/fixed size
- Portals take time to open. If this time is long, it may rule out the kinetic energy weapon, as it relies on rapid re-direction.
- The portal wormhole impedes the flow of electricity. This one sounds a bit like 'hand waving science' but it could be used to kill free electrical energy.
- The portal wormhole limits the velocity of transmitted matter. Why it would do this I don't know, but it severely limits the extreme applications of free kinetic energy.
- After being open for a while, portals become unstable and collapse. This nixes most of the exotic machines, although with some cleverness it could be circumvented, depending on how long the portals stay open, and how long it takes to get them back up.
- Portals are extremely costly to open or maintain. Whether in terms of energy, exotic materials, or whatever else, this is a pretty good reason to just say "We could do it, but it's too expensive!"

The Crazy Grappling Hook

Combine a grappling hook with a tripod and a portal gun, and you have the makings of a reaction-less drive. Players could move large objects by placing two portals on the same side and grappling to both sides of the portal. The little winch would do the rest. This would allow them to slide huge objects, or lift them into the air. It could be used to propel vehicles, or crash them. The grappling hook could also just be a grappling hook, lowering the player down from the ceiling. The most fun (I think) would be using it like the grappling hook in "Worms" to almost-fly around areas. The trick is that the grappling

hook would be attached through a portal, so you could always haul yourself in to safety (or danger, if that's where the portal goes).

The Waterworks

I've always liked playing with pipes and water flow. If the portal could transmit water, it could be used to flood rooms, or drain them. Players could launch themselves on a stream of high pressure water from the bottom of a cistern, or blast enemies with it. Water pressure could move, float, quench, or drown all kinds of things. A portal with pressure behind it could alternately drive pistons or machinery. In a pinch, a shallow body of water could be turned into a powerful squirt gun through the vertical loop method. Redirecting flow through pipes or channels alone could be the basis for a series of levels.

The Factory Kingpin

What if a factory ran on portals? The player could use the portals to activate or power machines. Portals could allow stationary robots access to far away areas which require maintenance or construction. Bulk raw materials could be loaded or unloaded from hoppers. Maybe the power generators of a facility rely on portals, which have collapsed. The player must re-open them to return power to the facility.

If the factory is doing something the player doesn't want, a portal gun could easily be used to wreak havoc. Welders could destroy sensitive electronics. The molten metal from the foundry could be poured over machines. Raw material could be hurled about. If the portal was large enough, whole machines could be dropped on each other.

The Hijacker

The portal gun only controls one pair of portals. However, from the game we know that portals can be created without guns. If the portal gun could "hijack" these portals then long sequences of portals could be set up. For instance, the player controls portals A and B. There is an existing pair, C and D somewhere in the area. The player could set up portals A and B where he wanted them, then walk over to either portal C or D and gain control of that pair, subsequently placing them. Alternately, hijacking a portal could cross the links. So if (from the previous example) the player hijacks portal C in place of portal A, then portal C is now linked to portal B, and portal A is linked to portal D. Confusing? Yes, but oh so fun. By controlling multiple pairs of portals, series could be set up, or "pipelines" which all lead to each other.

If even more difficulty was desired, portals could become one-way, with sets of three or more portals linking in an intradimensional triangle (square, pentagon, etc).

Transport Mayhem

If portals can be placed on moving objects or surfaces then a whole set of puzzles open up. Put a portal on a block and then push it off a ledge to reach an inaccessible area. If portals can be of varying size, then a small portal could be placed on a block, which would then be shoved through a larger portal. Moving walls or platforms could hold portals. There could even be surfaces on which portals don't quite "stick" and thus the

portal “slides” along the surface (Down? Up? Sideways?). Moving portals adds another dimension to an already interesting concept.

Gunslinger

Using the idea of a small mobile kinetic energy weapon, the portal could be employed as a weapon to defeat enemies. Some sort of chamber/tube/column built for the purpose would probably be required, since lining up vertical portals perfectly is a pain. This could also allow a player to portal back to base, re-arm the acceleration column with junk, and then head out again, ready to blast foes with flying radios and old folding chairs.

Spacemen

Zero gravity seems like the perfect environment for portals. It emphasizes the three-dimensional nature of the portal gun, as well as the freedom the portals provide. Puzzles (or combat) in zero-gee would have to be more environmental, with lots of lining up portals, or making carefully aligned jumps and sailing through sequential portals placed on the go. A zero-gee environment created with portal technology could even exist in the middle of an otherwise normal gravity area.

Closing Notes

When I heard about the concept of Portal I downloaded and played through Narbacular Drop and several of the player-created expansions. Now that Portal has come out I’ve already beaten the Bonus Levels, and I intend to play through the game many more times.

The above ideas were thought up one day while at work. I’m an engineer, so they tend to be technical. The thoughts are by no means complete, and I’m sure I could come up with much more if you’re interested. I hope it helps make more great games like Portal. I’ll be in line to buy the next one!

Good luck!

Paul Spooner
dudecon@hotmail.com
www.peripheralarbor.com