ABSTRACT

Teleportation is the name given by the science fiction writers to the feat of making an object or person disintegrate in one place while the exact replica appears somewhere else. The original object is scanned in such away as to extract all the information from it, then this information is transmitted to the receiving location and used to construct the replica, not necessarily from the actual material of the original, but perhaps from atoms of same kinds, arranged in exactly the same pattern as the original. A teleportation machine would look like a fax machine, except that it would work on both 3-dimensional objects as well as documents, it would produce an exact copy rather than approximate facsimile. A few science fiction writers consider teleportation that preserve the original, and the plot gets complicated when the original and teleported versions of same person meet; but the more common kind of teleportation destroys the original, functioning as a super transportation device, not as a perfect replicator of souls and bodies.

##### INTRODUCTION

Ever since the wheel was invented more than 5,000 years ago, people have been inventing new ways to travel faster from one point to another. The chariot, bicycle, automobile, airplane and rocket have all been invented to decrease the amount of time we spend getting to our desired destinations. Yet each of these forms of transportation shares the same flaw: They require us to cross a physical distance, which can take anywhere, from minutes to many hours depending on the starting and ending points. There are scientists working right now on such a method of travel, combining properties of telecommunications and transportation to achieve a system called **teleportation.**

Teleportation Technology is the 21st century alternative to travel. It can save your organization time and money and enhance your internal and external communication network. These systems are very simple to use. All you have to do is click to connect and you can appear within a 3-dimensional setting in a chair or behind a lectern on the other side of the world - almost instantly. The products are designed so that the technology is invisible. This means you always concentrate on the person or people you are talking with and not the technology.

Teleportation is developing a global network of teleportation facilities, which will include most major world cities during 2007. Organizations from across the world have been attracted by the immediate savings and improved communication that our technology can bring to their organization.

For natural high quality, distance communication there is no substitute. It really is the closest thing to being there/

WHAT IS TELEPORTATION TECHNOLOGY?

**DEFINITION :**

Teleportation is the duplication or re-creation or dematerialization of physical objects or their properties using light beams, according to researchers at the California Institute of Technology.

Also calling it quantum teleportation, the researchers have successfully transmitted information about the properties of an object at the speed of light so that the object could theoretically be duplicated or reconstructed at the destination.

The Teleportation communications system is unique and has been designed to enable a life-size image of a person to appear within a 3D environment. You can make eye contact with individuals, use props and hold true two-way conversations - communicating naturally with anyone or any group of people anywhere in the world, as you would if you were there. After all 80% of communication is non-verbal. The only thing you can't do is shake hands!

HISTORY

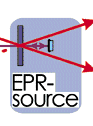
**An experiment confirms that teleportation is possible:**

Captain Kirk and his crew do it all the time with the greatest of ease: they discorporate at one point and reappear at another. However, this form of travel long has seemed remote to the realm of possibility. Now, however, it turns out that in the strange world of quantum physics, teleportation is not only theoretically possible, it can actually happen.

One group of researchers at the University of Innsbruck in Austria published an account of the first experiment to verify quantum teleportation in the December 11 issue of Nature. In addition, another team headed by Francesco De Martini in Rome has submitted similar evidence to Physical Review Letters for publication. Neither group sent a colleague to Katmandu or a car to the moon. Yet what they did prove is still pretty startling. Anton Zeilinger De Martini and their colleagues demonstrated independently that it is possible to transfer the properties of one quantum particle (such as a photon) to another--even if the two are at opposite ends of the galaxy.

Until recently, physicists had all but ruled out teleportation, in essence because all particles behave simultaneously like particles and like waves. The trick was this: they presumed that to produce an exact duplicate of any one particle, you would first have to determine both its particle like properties, such as its position, and its wavelike properties, such as its momentum. Yet doing so would violate the Heisenberg uncertainty principle of quantum mechanics. Under that principle, it is impossible to ever measure wave and particle properties at the same time. The more you learn about one set of characteristics, the less you can say about the other with any real certainty.

In 1993, though, an international team of six scientists proposed a way to make an end-run around the uncertainty principle. Their solution was based on a theorem of quantum mechanics dating to the 1930s called the **Einstein-Podolsky-Rosen effect**. It states that when two particles come into contact with one another, they can become "entangled". In an entangled state, both particles remain part of the same quantum system so that whatever you do to one of them affects the other one in a predictable, domino-like fashion. Thus, the group showed how, in principle, entangled particles might serve as "transporters" of sorts. By introducing a third "message" particle to one of the entangled particles, one could transfer its properties to the other one, without ever measuring those properties.



**Experimental proof**

Bennett's ideas were not verified experimentally until the Innsbruck investigators performed their recent experiment. The researchers produced pairs of entangled photons and showed they could transfer the polarization state from one photon to another.

Teleportation still has one glitch: In the fuzzy realm of quantum mechanics, the result of the transfer is influenced by the receiver's observation of it. (As soon as you look at, say, Bones, it will look like something else.) Therefore, someone still has to tell the receiver that the transformation has been made so that they can correctly interpret what they see. And this sort of communication cannot occur at faster-than-light speeds. Even so, the scheme has definite applications in ultra fast quantum computers and in utilizing quantum phenomena to ensure secure data transmission.

In 1993, Charles Bennett (IBM, TJ Watson Research Center) and colleagues theoretically developed a method for quantum teleportation. Now, a team of physicists from Caltech, Aarhus University, and Dr. Sam Braunstein of the University of Wales, Bangor has successfully achieved quantum teleportation of optical coherent states.

Quantum teleportation is similar to the far-fetched 'transporter' technology used in the television series 'Star Trek'. "Quantum teleportation involves the utter destruction of an unknown physical entity and its reconstruction at a remote location," says Professor H. Jeff Kimble, the leader of the research group at Caltech, who with Braunstein conceived the experiment. Using a phenomenon known as 'quantum entanglement', the researchers force a photon of light to project its unknown state onto another photon, with only a miniscule amount of information being sent between the two. This is the first time quantum teleportation has been performed with a high degree of 'fidelity', which means that the output reproduces the input with good accuracy. Quantum teleportation was announced earlier last year by two independent labs in Europe, but the low-fidelity results achieved in these experiments could also be explained away by standard (classical) optics, without invoking teleportation at all. There has been much progress in the field, but not an actual demonstration until now.

In the October 23 1998 issue of Science, the physicists described how they used squeezed-state entanglement to teleport light. In previous teleportation experiments (announced over the last year by separate research groups in Austria and Rome), only two-dimensional discrete variables (e.g. the polarization states of a photon, or the discrete levels of a two-level atom) were teleported. In this recent experiment, however, every state, or the entire quadrature phase amplitude, of the light beam was teleported. In the Science article, the researchers explain that teleporting optical fields may someday be appropriate for the use in communication technology.

HOW TELEPORTATION WORK’s?:

**PHOTON EXPERIMENTS:**

In 1998, physicists at the California Institute of Technology (Caltech), along with two European groups, turned the IBM ideas into reality by successfully teleporting a **photon**, a particle of energy that carries light. The Caltech group was able to read the atomic structure of a photon, send this information across 1 meter (3.28 feet) of coaxial cable and create a **replica** of the photon. As predicted, the original photon no longer existed once the replica was made.

In performing the experiment, the Caltech group was able to get around the **Heisenberg Uncertainty Principle**, the main barrier for teleportation of objects larger than a photon. This principle states that you cannot simultaneously know the location and the speed of a particle. But if you can't know the position of a particle, then how can you teleport it ? In order to teleport a photon without violating the Heisenberg Principle, the Caltech physicists used a phenomenon known as **entanglement**. In entanglement, at least three photons are needed to achieve quantum teleportation:

* Photon A: The photon to be teleported
* Photon B: The transporting photon
* Photon C: The photon that is entangled with photon B

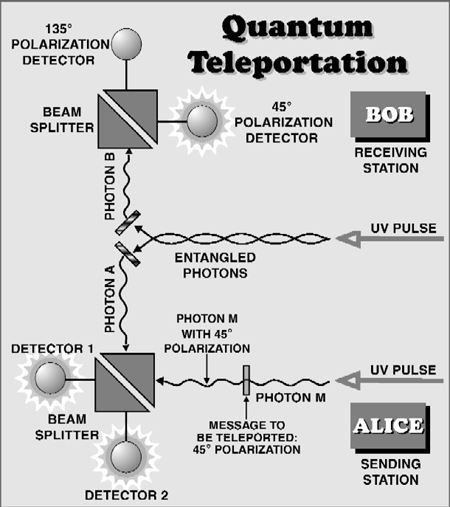
If researchers tried to look too closely at photon A without entanglement, they would bump it, and thereby change it. By entangling photons B and C, researchers can extract some information about photon A, and the remaining information would be passed on to B by way of entanglement, and then on to photon C. When researchers apply the information from photon A to photon C, they can create an exact replica of photon A. However, photon A no longer exists as it did before the information was sent to photon C.

A more recent teleportation success was achieved at the Australian National University, when researchers successfully teleported a laser beam.

While the idea of creating replicas of objects and destroying the originals doesn't sound too inviting for humans, quantum teleportation does hold promise for quantum computing. These experiments with photons are important in developing networks that can distribute quantum information. Professor **Samuel Braunstein**, of the University of Wales, Bangor, called such a network a "quantum Internet." This technology may be used one day to build a quantum computer that has data transmission rates many times faster than today's most powerful computers.

**THE INNSBRUCK EXPERIMENT:**

IMAGE DEPICTS the University of Innsbruck experimental setup for quantum teleportation. In the quantum teleportation process, physicists take a photon (or any other quantum-scale particle, such as an electron or an atom) and transfer its properties (such as its polarization - the direction in which its electric field vibrates) to another photon - even if the two photons are at remote locations. The scheme does not teleport the photon itself; only its properties are imparted to another, remote photon.



Here is how it works: At the sending station of the quantum teleporter, Alice encodes a "messenger" photon (M) with a specific state: 45 degrees polarization. This travels towards a beam splitter. Meanwhile, two additional "entangled" photons (A and B) are created. The polarization of each photon is in a fuzzy, undetermined state, yet the two photons have a precisely defined interrelationship. Specifically, they must have complementary polarizations. For example, if photon A is later measured to have horizontal (0 degrees) polarization, then the other photon must "collapse" into the complementary state of vertical (90 degrees) polarization.

Entangled photon A arrives at the beam splitter at the same time as the message photon M. The beam splitter causes each photon to both continue toward detector 1 or change course and travel to detector 2. In 25% of all cases, in which the two photons go off into different detectors, Alice does not know which photon went to which detector. This inability of Alice to distinguish between the two photons causes quantum weirdness to kick in. Just by the very fact that the two photons are now indistinguishable, the M photon loses its original identity and becomes entangled with A. The polarization value for each photon is now indeterminate, but since they, travel toward different detectors Alice knows that the two photons must have complementary polarizations.

Since message photon M must have complementary polarization to photon A, then the other entangled photon (B) must now attain the same polarization value as M. Therefore, teleportation is successful. Indeed, Bob sees that the polarization value of photon B is 45 degrees: the initial value of the message photon.

CLASSIFICATION

Teleportation is classified in to

1)Human Teleportation

2)Quantum Teleportation

**HUMAN TELEPORTATION:**

For a person to be transported, a machine would have to be built that can pinpoint and analyze all of the 1028 atoms that make up the human body. That's more than a trillion atoms. This machine would then have to send this information to another location, where the person's body would be reconstructed with exact precision. Molecules couldn't be even a millimeter out of place, lest the person arrive with some severe neurological or physiological defect.

If such a machine were possible, it's unlikely that the person being transported would actually be "transported." It would work more like a fax machine a duplicate of the person would be made at the receiving end, but with much greater precision than a fax machine. But what would happen to the original? One theory suggests that teleportation would combine genetic cloning with digitization.

In this biodigital cloning, tele-travelers would have to die, in a sense. Their original mind and body would no longer exist. Instead, their atomic structure would be recreated in another location, and digitization would recreate the travelers' memories, emotions, hopes and dreams. So the travelers would still exist, but they would do so in a new body, of the same atomic structure as the original body, programmed with the same information.

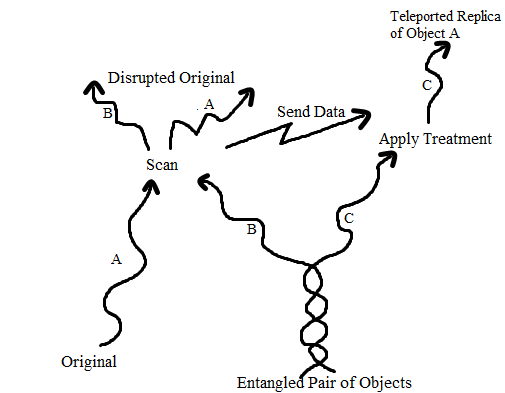
But like all technologies, scientists are sure to continue to improve upon the ideas of teleportation, to the point that we may one day be able to avoid such harsh methods. So as human teleportation is not yet achieved, we mainly focus on quantum teleportation in this topic.

**QUANTUM TELEPORTATION:**

Teleportation is the name given by science fiction writers to the feat of making an object or person disintegrate in one place while a perfect replica appears somewhere else. How this is accomplished is usually not explained in detail, but the general idea seems to be that the original object is scanned in such a way as to extract all the information from it, then this information is transmitted to the receiving location and used to construct the replica, not necessarily from the actual material of the original, but perhaps from atoms of the same kinds, arranged in exactly the same pattern as the original. A teleportation machine would be like a fax machine, except that it would work on 3-dimensional objects as well as documents, it would produce an exact copy rather than an approximate facsimile, and it would destroy the original in the process of scanning it. A few science fiction writers consider teleporters that preserve the original, and the plot gets complicated when the original and teleported versions of the same person meet; but the more common kind of teleporter destroys the original, functioning as a super transportation device, not as a perfect replicator of souls and bodies.

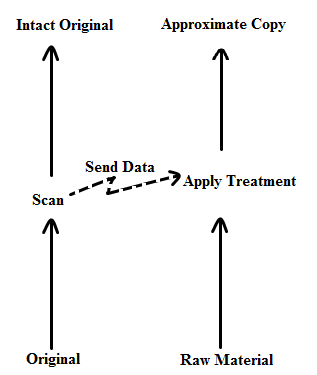
Until recently, teleportation was not taken seriously by scientists, because it was thought to violate the uncertainty principle of quantum mechanics, which forbids any measuring or scanning process from extracting all the information in an atom or other object. According to the uncertainty principle, the more accurately an object is scanned, the more it is disturbed by the scanning process, until one reaches a point where the object's original state has been completely disrupted, still without having extracted enough information to make a perfect replica. This sounds like a solid argument against teleportation: if one cannot extract enough information from an object to make a perfect copy, it would seem that a perfect copy cannot be made.

But the six scientists found a way to make an end-run around this logic, using a celebrated and paradoxical feature of quantum mechanics known as the **Einstein-Podolsky-Rosen effect**. In brief, they found a way to scan out part of the information from an object A, which one wishes to teleport, while causing the remaining, unscanned, part of the information to pass, via the Einstein-Podolsky-Rosen effect, into another object C which has never been in contact with A. Later, by applying to C a treatment depending on the scanned-out information, it is possible to maneuver C into exactly the same state as A was in before it was scanned. A itself is no longer in that state, having been thoroughly disrupted by the scanning, so what has been achieved is teleportation, not replication.



As the figure suggests, the unscanned part of the information is conveyed from A to C by an intermediary object B, which interacts first with C and then with A. What? Can it really be correct to say "first with C and then with A"? Surely, in order to convey something from A to C, the delivery vehicle must visit A before C, not the other way around. But there is a subtle, unscannable kind of information that, unlike any material cargo, and even unlike ordinary information, can indeed be delivered in such a backward fashion. This subtle kind of information, also called "Einstein-Podolsky-Rosen (EPR) correlation" or "entanglement", has been at least partly understood since the 1930s when it was discussed in a famous paper by Albert Einstein, Boris Podolsky, and Nathan Rosen. In the 1960s, John Bell showed that a pair of entangled particles, which were once in contact but later move too far apart to interact directly, can exhibit individually random behavior that is too strongly correlated to be explained by classical statistics. Experiments on photons and other particles have repeatedly confirmed these correlations, thereby providing strong evidence for the validity of quantum mechanics, which neatly explains them.

Another well-known fact about EPR correlations is that they cannot by themselves deliver a meaningful and controllable message. It was thought that their only usefulness was in proving the validity of quantum mechanics. Now it is known that, through the phenomenon of quantum teleportation, they can deliver exactly that part of the information in an object, which is too delicate to be scanned out, and delivered by conventional methods.

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This figure compares conventional facsimile transmission with quantum teleportation (see above). In conventional facsimile transmission, the original is scanned, extracting partial information about it, but remains more or less intact after the scanning process. The scanned information is sent to the receiving station, where it is imprinted on some raw material (example: paper) to produce an approximate copy of the original. In quantum teleportation, two objects B and C are first brought into contact and then separated. Object B is taken to the sending station, while object C is taken to the receiving station. At the sending station object B is scanned together with the original object A which one wishes to teleport, yielding some information and totally disrupting the state of A and B. The scanned information is sent to the receiving station, where it is used to select one of several treatments to be applied to object C, thereby putting C into an exact replica of the former state of A.

QUANTUM INFORMATION PROCESSING

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APPLICATIONS :

* Cooperative 3D work: designers, architects or engineers could use teleportation for distributed manipulation and visualization of 3D objects as for example in shared CAD applications.
* Distributed negotiation: sensitive negotiation and conflict resolution meeting are

best held face to face.

* The physically disabled: for such people teleport offers a natural way of

communicating with other people.

* Education and consulation: teachers or professors could meet directly with students

located in other cities or countries.

FEATURES :

* Merging of real and virtual environments.
* Viewer tracking and real time rendering.
* An image segmentation system capable of extracting participants from a controlled

background.

* Composition of live video with synthetic background.

GOALS :

Like all technologies, scientists are sure to continue to improve upon the ideas of

teleportation.

* To demonstrate the use of wall sized displays integrated in a working living

environment.

* To demonstrate an immersive teleconferencing environment without need for head

mounted displays.

ADVANTAGES

Teleportation Technology is now being used by organizations across the world to enable people to be in two (or more) places at once. These organizations have recognized the substantial communication benefits of the technology:

* Genuine eye-to-eye contact with individuals or audiences in the distant location, which means you, can make that personal connection count wherever you are.
* The quality of the communication means that you are able to see and respond to the mood and body language of the person you are speaking with to build trust and understanding.
* There is natural two-way communication with no audio interference or discernable latency even if the communication is across twelve time zones.
* You can take control of PowerPoint and other presentation material, which would be seen by the audience instantly - in real time as you are talking
* With access to the Teleportec Global Network you just "click to connect" with any of the Teleportec facilities across the EU, North America and Australasia via our Operating System.
* The financial benefits are significant too.
* Substantial savings in travel and accommodation costs
* Less non productive travel time means more efficient use of your valuable human resources
* No expensive training required - The technology is very easy to use.
* You can be there when travel is impossible.
* Video conferencing has never presented itself as a realistic alternative to face-to-face meetings because of its severe limitations - only one person can speak at any one time creating an amplified feeling of distance between participants. Teleportation allows a more natural form of conversation due to the lack of latency - people achieve a sense of presence that cannot be gained from any other technology.
* Teleportec has systems installed in cities across the world each utilizing a range of connectivity options including ISDN, T1, and ATM and over the Internet. Teleportec is currently developing applications for the Internet 2 - the most advanced network in the world.
* We would start with an analysis of how teleportation technology could improve your business communication. Our team will install the custom systems and commission the teleportation technologies. Ongoing operational support will be provided in over 50 countries through our strategic partners.

CONCLUSION

**( Classroom of the future )**

Teleportation technology is fast becoming an integral part of the classroom of the future. The UK Government in its latest Education Excellence in Cities Newsletter makes it clear that the technology "opens the way for innovation and new ways of teaching and learning". Over the past twelve months, Teleportec has been working with educational establishments across the world in the development of a global network of institutions. The vision of being able to teleport people into the classroom for history lessons and cultural exchange is now being realized. Schools in Salford, Greater Manchester in the UK and Texas in the USA are using the technology to share knowledge and experiences on a weekly basis. Schools in mainland Europe and Australia are also getting involved. Justin Wilson, Director of Salford's City Learning Center believes that "the use of the technology will be an important motivational tool for gifted and talented pupils"

In October, systems were installed at schools in Padre Island, Texas as an emergency measure when the bridge linking it to the mainland was destroyed. Since then, a large part of the curriculum has been delivered virtually. Teleportec are planning a series of global events for education over the coming months. Please contact Teleportec for further information. The cost of this equipment is nearest 35 lacks.

With the help of teleportation , the subject will be teleported to the destination at the speed of light, which is the real advantage & spirit behind the research of teleportation. So think about your office or college as easily as you were going to house in your neighborhood or reaching a star or a planet at a speed which Newton or Einstein have not dreamed to be possible.

As all good things have limits teleportation also has its limits. The teleporter transfers matter at a speed of light & we know that light has its speed limit; the feeling of instantaneous teleportation is felt only on Earth & distances comparable with, or less than the speed of light.

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