Reversing Paralysis

An Analysis on the Effects of the Emerging Technology

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March 22, 2019

Reversing Paralysis

Background Information

Context

- Paralysis is the inability to move some part of the body, or not even being able to move at all
  - Caused by serious accidents or injuries, other medical conditions, and other damages to the nervous system
- Traditional treatments include:
  - Mobility aids (e.g. wheelchairs, arm braces);
  - Physiotherapy (to maintain and regain strength and muscle mass);
  - Occupational therapy (lifestyle changes to accommodate the injury);
  - Medicine (e.g. to treat pain, stiffness, spasms)

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What is it?

The Emerging Technology

- Reversing paralysis is a group of technologies that aims to undo some or all of the nerve damage that causes paralysis
- Upcoming technologies are mostly concerned with treating spinal cord injuries

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Examples

Brain implants to bypass damaged nerve tissue

- A recording device is placed beneath its skull, touching the motor cortex
- This device is wirelessly connected to a series of electrodes near the damaged area
- Creates a neural bypass that allows people to move again

Spinal implants to replace damaged nerves

- Electrically stimulates an individuals spinal cord
- Amplifies weak signals from the brain that would be otherwise ineffective

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Examples

Functional electric stimulation (FES) to improve diseased/paralyzed muscles

- Improves upon current therapeutic techniques
- One study presents a case of hysterical paralysis (psychiatric disorder that is difficult to explain)
- Patient, with daily FES treatment, showed dramatic improvement in two weeks

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Societal and Cultural Effects

Effect on Society

- Increased quality of human life
  - Disability can lead to internalized oppression
  - An individual internalizes prejudices held by dominant group
- Shifts the way society addresses disability
- Exacerbate the divide between the rich and the poor
  - Ethics of medical treatment

Effect on Culture

- Change in attitudes, stereotypes, and accommodations
  - Removes existing stigma surrounding disability
- Disability culture: celebrating differences between people
- Could damage the sense of unity in the disabled community
  - E.g. the positive effect of intellectually disabled children on families

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Economic Effects

Effects on the Local Economy

- Increased productivity
  - According to the Canadian Society of Professionals in Disability Management,a worker earning $50,000 a year who becomes disabled at age 35 will lose almost $400,000 in the 30 years before retirement, based on 60% long-term disability coverage
- Decreased government spending
  - In 2012, a poll determined that Canadians drastically underestimated the cost of spinal cord injury on society to be $100 million
  - The real cost was $3 billion
- High costs of treatment

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Economic Effects

Effects on the World Economy

- Research opportunities in reversing paralysis
  - Create employment in manufacturing, researchers, medical professionals
- Increased global productivity, with advancements in health care
- Employment opportunities for previously paralyzed people
  - Disabled people are employed at significantly lower rates
  - According to a seminar given at the UN, the 200 million disabled people worldwide experience higher rates of poverty
- Potential devastation on the pre-existing disability sector of health care

Effects on the Environment

- Manufacturing of mobility aids could become obsolete
  - Reduced waste, harmful greenhouse gas emissions as a result of wheelchairs, braces, and other equipment
- New technology could benefit or harm the environment
  - Technology that could be hard to dispose
  - Recyclable, small components could have minimal impact
  - Difficult to manufacture complex components
- New environmental legislation:
  - Strict manufacturing laws for manufacturing technologies
  - Recycling used electrical components (wires, electrodes)
  - Making sure waste is properly disposed of

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Environmental Effects

Reducing Environmental Impact

- Federal government legislation
  - E.g. Canadian Environmental Quality Guidelines
  - Permits and licenses for manufacturers of reversing paralysis technology
- Reallocation of the provincial government
  - Reduced health care costs will instead be spent on enforcing legislation
- Recycle and repurpose previous, obsolete equipment
  - Reuse material from wheelchairs and other mobility aids

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Health Effects

Effects on Human Health

- A severe, once irreversible condition will be treatable
  - Spinal cord injury and other nerve-related damage will no longer carry the same weight
- The general quality of life for disabled people will be improved
  - Not only is paralysis reversed, but the associated conditions as well
  - Depression, anxiety, overall mental health
  - Muscular atrophy
- Could lead to undesirable side effects and conditions
  - Rigorous testing and clinical trials
  - Strict legislation to protect against unforeseen effects
- Disregard and disparage spinal cord injuries

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Health Effects

Reducing Negative Impacts on Human Health

- Clinical trials and subject testing
  - Animals, human volunteers, controlled studies, simulations
  - Elucidate unknown side effects
- New medical treatment vetted, peer-reviewed
  - Health Products and Food Branch (HPFB) of Health Canada
  - Similar process to drug development
- Research and scientific studies
  - Private funding, reallocation of healthcare budget
  - University research and public donations

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Ethical Concerns

Ethical Issues

- Who gets treatment? Who decides?
  - The disparity in the quality of health care is likely to worsen
  - Those who can afford treatment will get it
- Potentially exploitable electronics
  - The dangers of implanting a hackable component
  - Pacemakers are equipped with a microprocessors
  - A wireless connection with a 'backdoor' to the heart
- How do we test the technology?
  - Dr. Grégoire Courtine, a leading researcher in reversing paralysis, tested his technology on various animals
  - Animal testing is a standard in medicine

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Ethical Concerns

Ethical Practices

- Who gets treatment? Who decides?
  - The government
  - International Health Regulations (IHR) and other world organizations (WHO, UN)
  - Subsidized treatment, insurance, social security network
- Potentially exploitable electronics
  - Strict policy, cybersecurity research
  - Jammers: block intrusive signals
  - Firewall: software-based solution to block signals
  - Password locks: Locking the technology with a password
  - Remove hackable components
- How do we test the technology?
  - Human tissue/cell cultures
  - Computer simulations
  - Volunteer studies

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Citations

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