

東京工業大學  
Tokyo Institute of Technology

# Science and Engineering Ethics

Week 4: How should technical experts behave?  
—What is behind proper decision making—

# Case study : Honda CVCC Engine Development

## ● Honda Motor Co., Ltd. (Honda)

- Founded in 1948, by Soichiro Honda, in Japan known as the “God of the Two Wheelers” and the “God of Technology.”
- Started a small factory that developed into one of the world’s top companies ← A combination of Soichiro Honda (technology) and Takeo Fujisawa (management)
- Excellent technical prowess and ideas highly regarded worldwide

↓ Everyone in Honda pulled together to work on

the CVCC engine development project,  
which was completed in 1972.

# Environment Concerns Begin

- 1960s : Speed was the goal
- Late 1960s : Environment becomes an important value
- Shizuo Yagi, an engineer in charge of engine development, felt that countermeasures for air pollution must be developed and, thus, he took initiative to begin research with colleagues.



"RA272 in the Honda Collection Hall" by Rainmaker47 is licensed under [CC BY-SA 3.0](#) / Desaturated from original  
[https://commons.wikimedia.org/wiki/File:RA272\\_in\\_the\\_Honda\\_Collection\\_Hall.JPG](https://commons.wikimedia.org/wiki/File:RA272_in_the_Honda_Collection_Hall.JPG)

# Environmental Regulations and Corporate Social Responsibility

- The U.S. had a more serious air pollution problem than in Japan
  - to mitigate the problem, the U.S. strengthened its environmental regulations for automobiles.



- 1970 Muskie Act: required a 90% reduction of the level of toxic substances in emissions gases over five years
  - Most car companies saw this as a ridiculous and impossible standard to meet.
    - But, what about Honda ? Soichiro saw it as an opportunity.

# CVCC Engine Development

- Soichiro Honda : Managerial decisions
  - “Development of a CVCC engine fulfilling the Muskie Act is possible. We will commercialize it by 1973.” February 1971
    - Despite the fact that this was not yet a “possibility,” this was boldly announced at a press conference without the approval of development managers.  
↑ ::
  - Business performance was sluggish due to a lawsuit alleging that a product defect caused a consumer’s death.
    - Soichiro thought that “success in engine development would lead to company revitalization, which would place Honda among the top companies in the world.”  
• //
    - He chose to “develop a new engine meeting Muskie Act standards” as a “manager” regardless of the costs to meet the “environmental” regulation.

# CVCC Engine Development

This became a great cause for engineers involved in the development project.

- Of course, this was an important project influencing the fate of the company.
- However, the engineers knew that efforts to tackle air pollution were not solely Honda's problem.

**“Let’s leave behind clean skies for our children.”**

- The words of Akira Ishizutani of the Pollution Research Laboratory.
- Engineers were motivated to develop an engine compliant with the Muskie Act for society.

# What is the purpose of this technical development?

- The future of the company depended on this project.
- The project was founded on a sense of responsibility among engineers.
  - Soichiro Honda was not the actual leader of the project. It was Tadashi Kume, who was 39 years old at the time.
  - Mr. Kume recognized that the success of this project was not simply the company's objective, but, instead, saw it as the "role of engineers." He shared this recognition with project members and did not tolerate defeat or compromise.
  - Even if Soichiro Honda expressed opposition, he pressed on without changing direction.

# Then, finally...

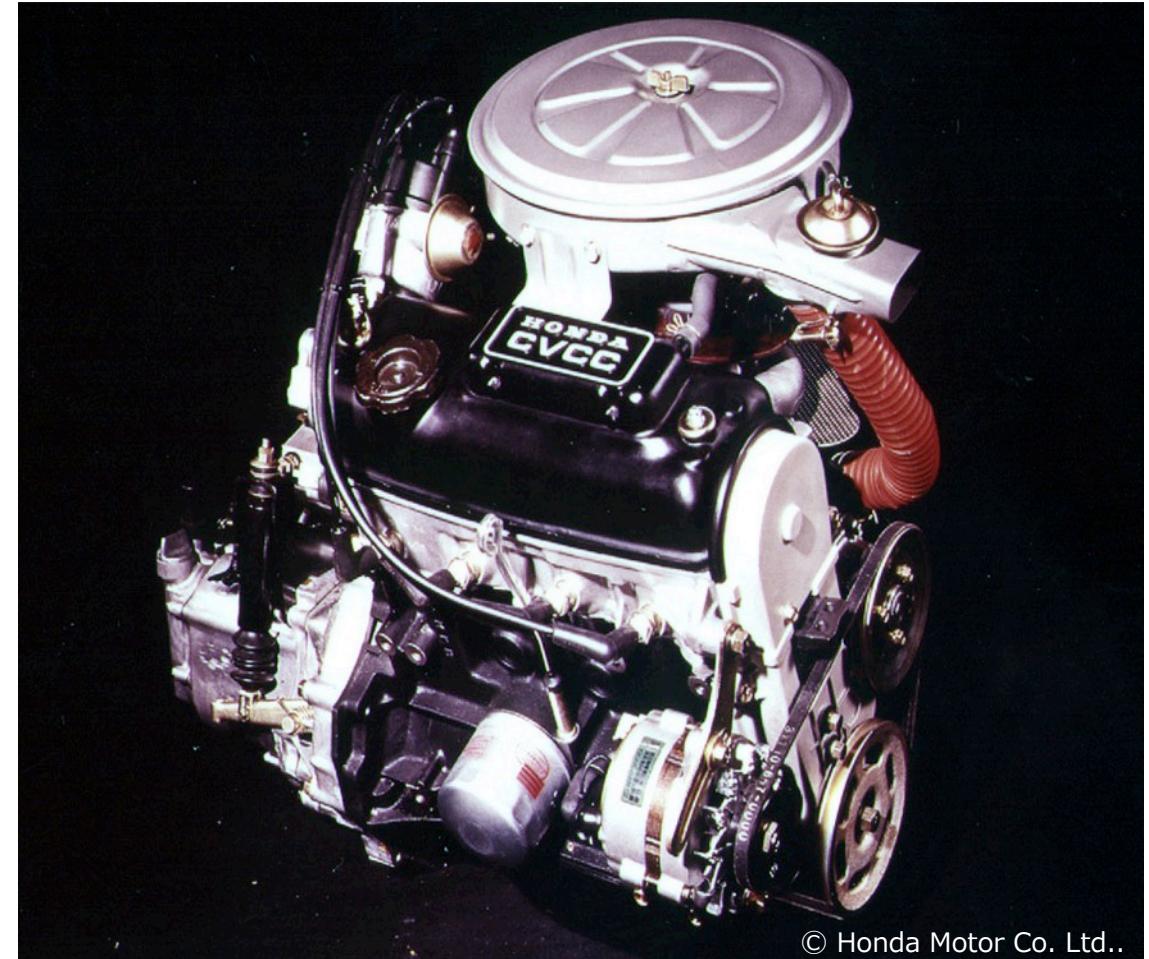
- In October 1972, a **CVCC engine** meeting all Muskie Act standards was announced.
- In December 1972, it was tested by the U.S. Environmental Protection Agency (EPA).
- In March 1973, the EPA officially announced that the **CVCC engine** complied with the Muskie Act.



- Following the announcement, Honda **shared the technology with other makers.**



- It was a big leap forward for emissions reductions in the global auto industry



© Honda Motor Co. Ltd..

# The CVCC engine made Honda a global name.

## The Civic CVCC

- Became a hit worldwide due to environmental friendliness and good fuel efficiency, and
- Demonstrated Honda's technical prowess to the world.

In 2000, this was the only Japanese "car with superior 20th century technology" as selected by the American Society of Automotive Engineers through a readership vote.

- In October 2005, the Civic CVCC was entered into the Japan Automotive Hall of Fame.



© Honda Motor Co. Ltd.,

# The Superior Ethics of Engineers

- In later years, Soichiro Honda said…

“During CVCC development, when I said that development of a low emission engine was a golden opportunity to be at the same starting line as the leading auto makers, young engineers insisted that emissions countermeasures weren’t a problem for the company, but an obligation of social responsibility for the auto industry. This was eye-opening and emotionally moving. … Everyone was developing steadily at the time. We have entered a period requiring fresh management based upon new values and a fresh sense of the relationship between the corporate world and society.”

# Two Aspects of Ethics

Aspirational Ethics		Preventive Ethics
Aspect	Want to do/should be done	Ought not to
Goal	Good decision making and good work	Prevent what should not be done
Direction	Contribution to well-being	Avoiding harms and protect safety and health
Orientation	Extroversion-oriented	Introversion-oriented
Effect	Encouraging/Inspiring	Withering

# The traditional responsibility models requires a particular ethic and social responsibility of engineers.

- “Social contract” model (engineering societies of Europe and America)
- “Social experiment” model (Martin & Schinzinger)
- “Interdependency” model (Fudano)

Mike W. Martin and Roland Schinzinger, Ethics in Engineering, 3rd Edition, New York : McGraw-Hill Publishing Company, 1996, pp.81-127

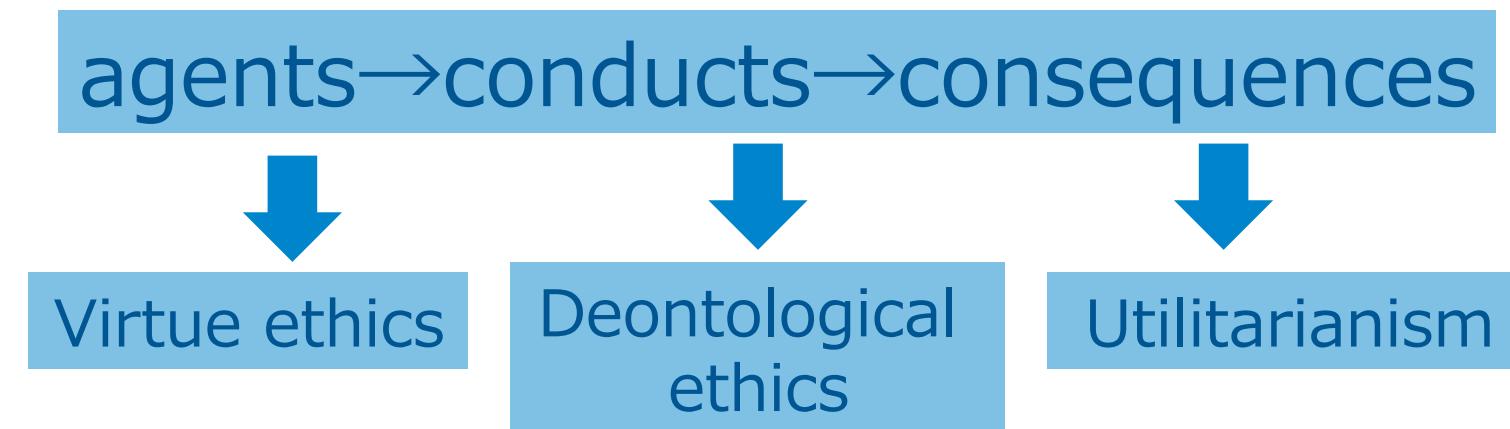
Charles E. Harris, Michael S. Pritchard, and Michael S. Pritchard, Engineering in Ethics : Concepts and Cases, New York : Wadsworth Publishing Company, 1995, ch.2

# Two Problems of Engineering Ethics 1.0

- Limits of the traditional responsibility model
  - Negative aspect of preventative ethics: people do not become engineers **only** to protect safety and health.
    - Some forget their obligation to contribute to humanity with the advancement of science and technology.
    - Essentially, there is a lack of scientific consideration related to society's "welfare/well-being."
- The "ethical schizophrenia" problem in which ethics focuses on actions (minimizing actor accountability and motivations)
  - Clash between deontology focusing on actions and utilitarianism

# Major Ethical Theories

Generally speaking, agents (change makers) generate some kind of consequences through conducts.



# New Model for Science and Engineering Ethics

Transcending the traditional responsibility models



Science and Engineering Ethics 2.0

# Basic Principles of Engineering Ethics

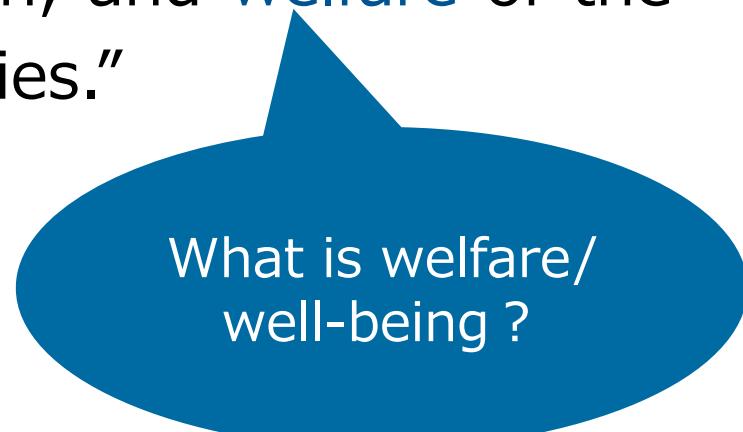
## Fundamental Canon 1

“Engineers shall hold paramount the safety, health, and **welfare** of the public in the performance of their professional duties.”

# Ethics of Technical Experts Basic Principles

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What is welfare/  
well-being ?

# Science Council of Japan Code of Conduct for Scientists

(Basic Responsibility of Scientists)

1. Scientists are responsible for the quality of the expertise and technology they create and for contributing to the health and welfare of humanity, the safety, peace, and order of society, and the sustainability of the global environment by using such expertise, technology, and experience.

# Mission of Tokyo Institute of Technology

As one of Japan's top universities, the Tokyo Institute of Technology seeks to contribute to civilization, peace, and prosperity in the world, and aims to develop superior global human capabilities through pioneering research and education in science and technology, including industrial and social management. To achieve this mission, we aim to educate highly moral students to acquire not only scientific expertise but also proficiency in the liberal arts along with a balanced knowledge of the social sciences and humanities, while thoroughly researching basic concepts/fundamentals to enable the future practice of science with academic knowledge. Through these activities, we wish to contribute to the global sustainability of the natural world and well-being of human life.

National University Corporation, Tokyo Institute of Technology  
Organization Management Regulations: Article 2, Clause 2

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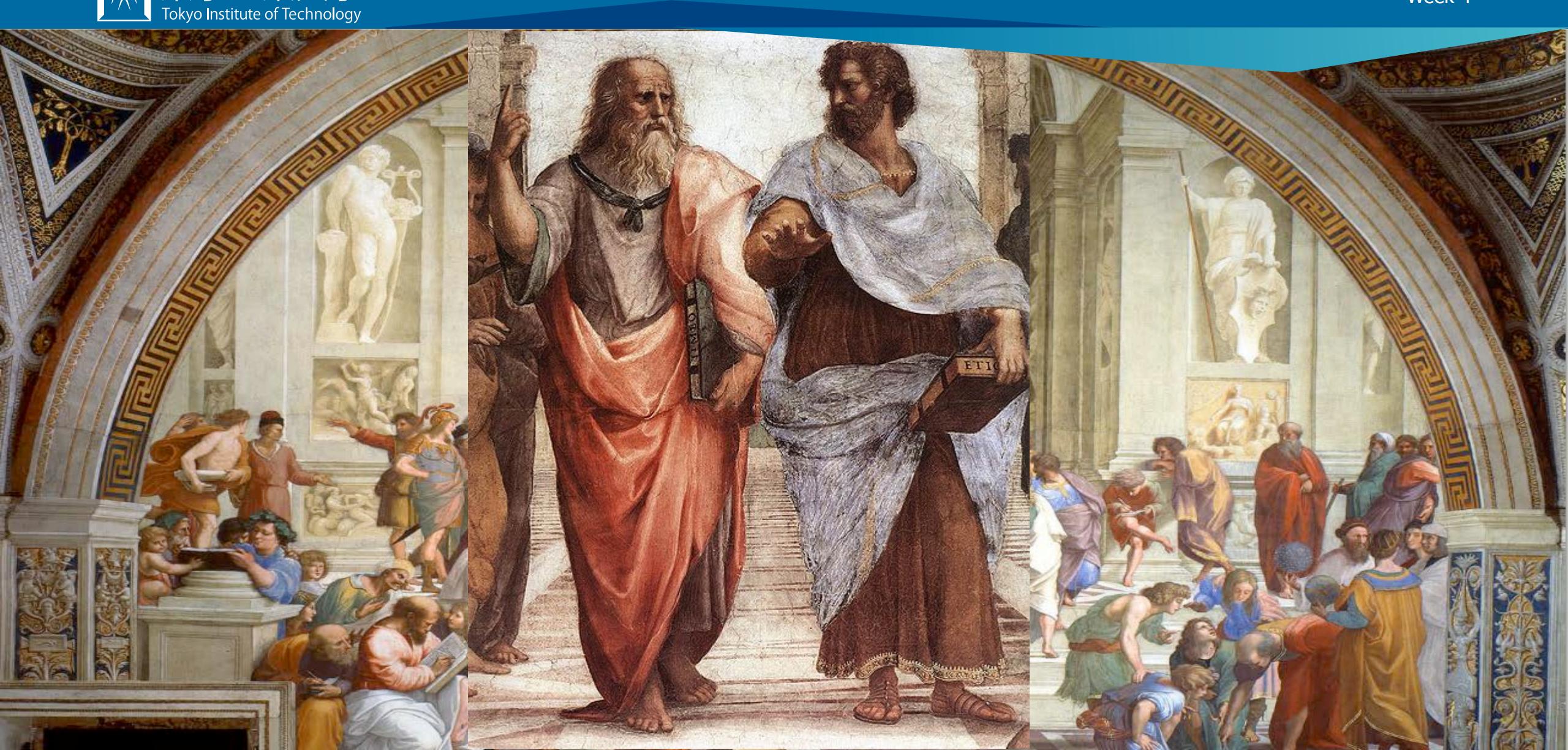
What is welfare/  
well-being ?

National University Corporation, Tokyo Institute of Technology  
Organization Management Regulations: Article 2, Clause 2



**The School of Athens**  
**(by Raffaello Sanzio da Urbino, 1509-10)**

"The School of Athens" by Raffaello Sanzio da Urbino  
[https://commons.wikimedia.org/wiki/File:Raphael\\_School\\_of\\_Athens.jpg](https://commons.wikimedia.org/wiki/File:Raphael_School_of_Athens.jpg)



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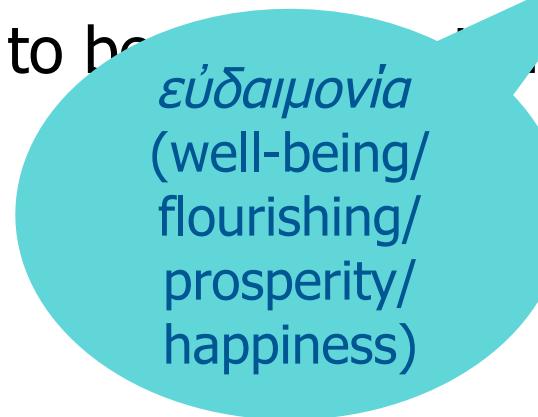
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## Ethics requires the consideration of well-being.

"To resume, inasmuch as all studies and undertakings are directed to the attainment of a stated good, let us discuss what it is that we pronounce to be the aim of Politics, that is, what is the highest of all the goods that action can achieve. As far as the name goes, we may almost say that the great majority of mankind are agreed about this; for both the multitude and persons of refinement speak of it as **eudaimonia**, and conceive 'the good life' or 'doing well' to be the same thing."

# Ethics requires the consideration of well-being.

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εὐδαιμονία  
(well-being/  
flourishing/  
prosperity/  
happiness)

(Aristotle, Nicomachean Ethics, §21; 1095a15-22)

# Well-being (happiness)?

“The point of living one’s life is to become a good person. That is to say, it is to attain the most sublime thing, which is happiness (eudaimonia: well-being).”

# The right to pursue happiness is a comprehensive, basic human right.

- Article 13 of the Constitution of Japan

All of the people shall be respected as individuals. Their right to life, liberty, and the pursuit of happiness shall, to the extent that it does not interfere with the public welfare, be the supreme consideration in legislation and in other governmental affairs.

# Well-being: A global focus has emerged

- Publications with features on well-being
  - TIME (Magazine)
  - U.S. News & World Report
  - “The Power of Positive Thinking” by Dr. Norman Vincent Peale
  - “How to Stop Worrying and be Happy: Positive Thinking Tips to Know How to be Happy” by Mike C. Adams

# 「World ranking of happiness」 (University of Leicester, 2006)

## Top 10

- 1: Denmark
- 2: Switzerland
- 3: Austria
- 4: Iceland
- 5: The Bahamas
- 6: Finland
- 7: Sweden
- 8: Bhutan
- 9: Brunei
- 10: Canada

## Ranks of other countries:

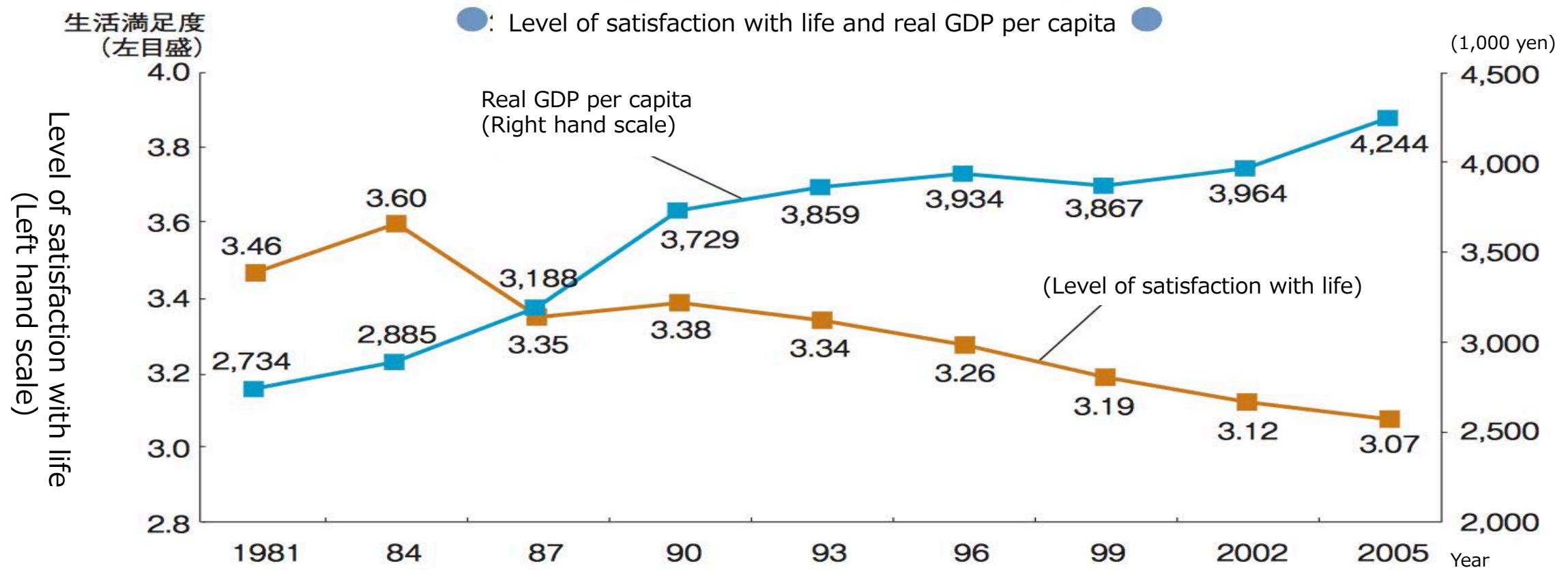
- 23: The United States
- 35: Germany
- 41: Britain (United Kingdom of Great Britain and Northern Ireland)
- 62: France
- 82: People's Republic of China
- 90: Japan**
- 125: India
- 167: Russia

## Japan according to OECD Well-being Indicators cited from:

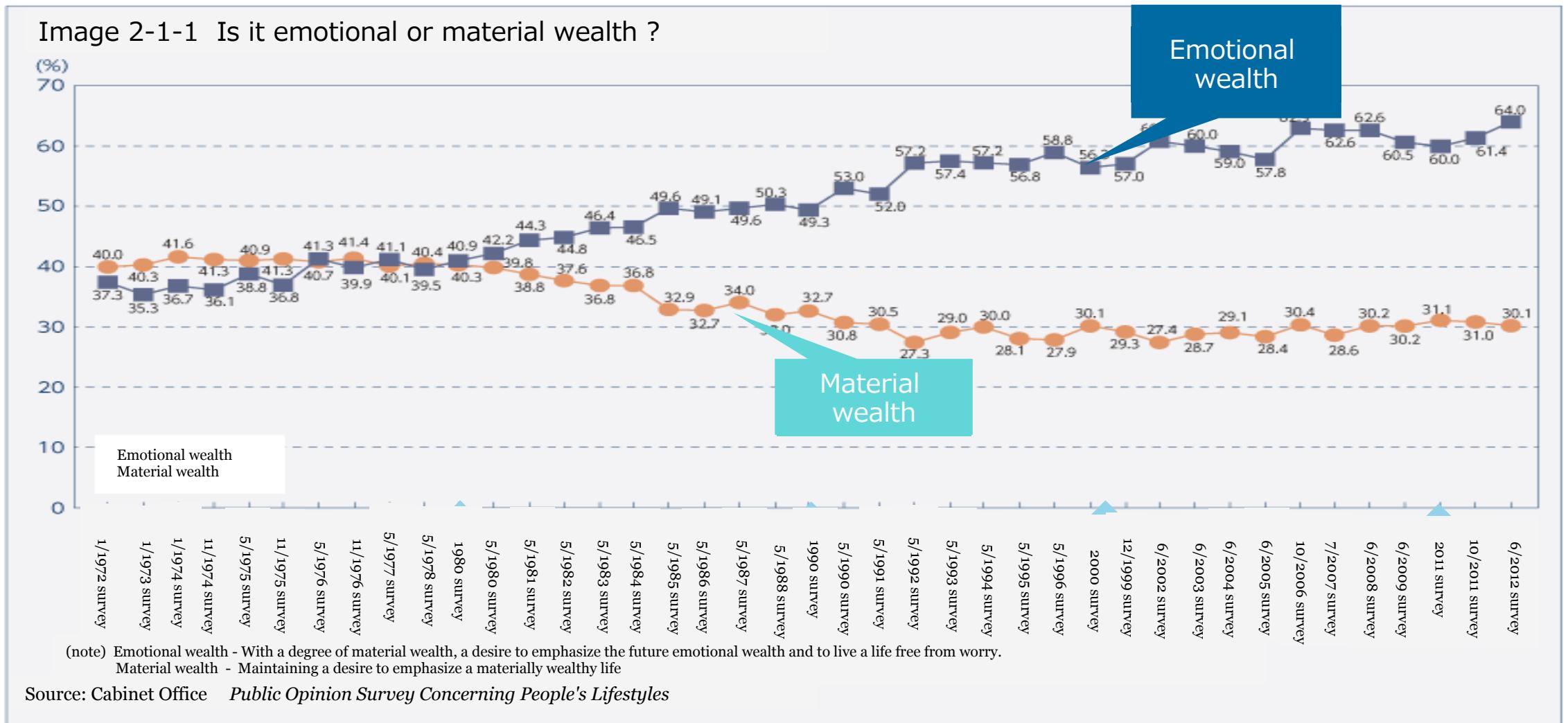
<http://www.oecd.org/statistics/BLI%202014%20Japan%20country%20report.pdf>

- Average or above average for housing, income, employment, education, environment, governance, health and peace of mind, and safety
- Level of satisfaction with life:  
40% of people are satisfied with their own lives (average: 59%)

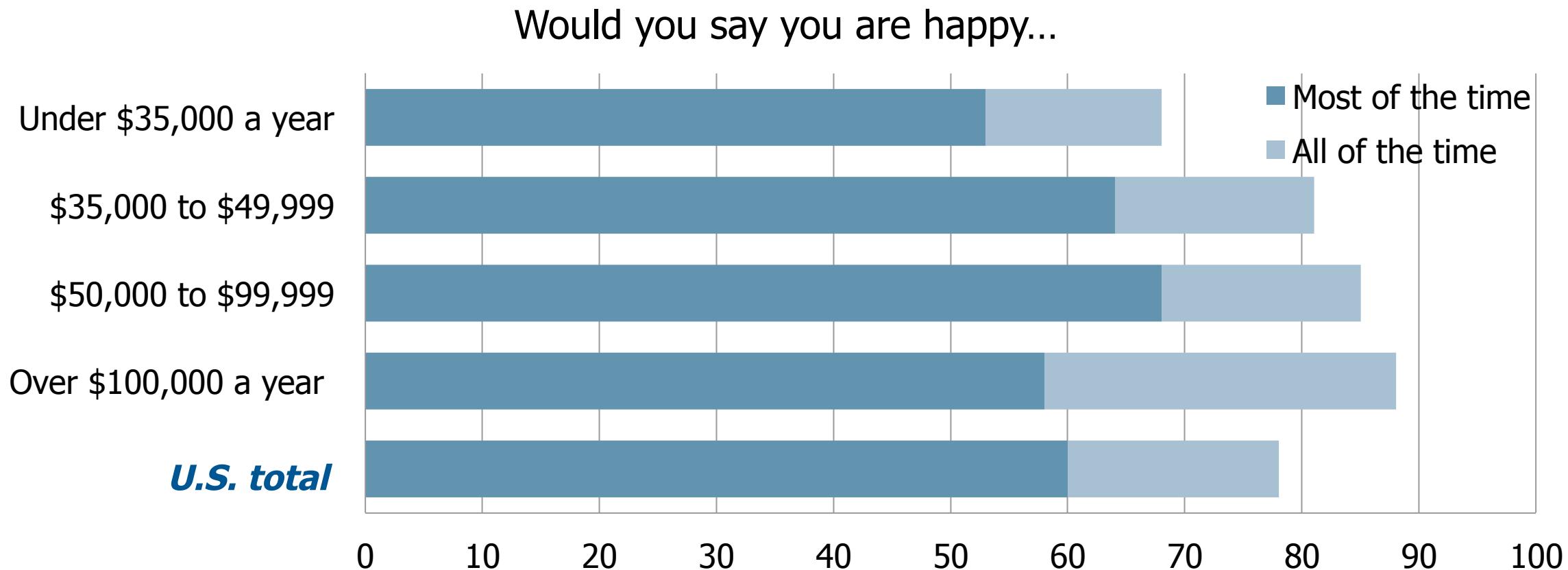
# Easterlin Paradox



## Is it emotional or material wealth ?



# Happiness and Income



"TIME POLL FEELING GOOD IN THE U.S., Just How Happy Are We? ..." (Time, Jan. 2005)

## What are your major sources of happiness? (Top eight answers)

- Your relationship with your children …77%
- Your friends and friendships …76%
- Contributing to the lives of others …75%
- Your relationship with spouse/partner or your love life …73%
- Your degree of control over your life and destiny …66%
- The things you do in your leisure time …64%
- Your relationship with your parents …63%
- Your religious or spiritual life and worship …62%
- Holiday periods, such as Christmas and New Year's …50%



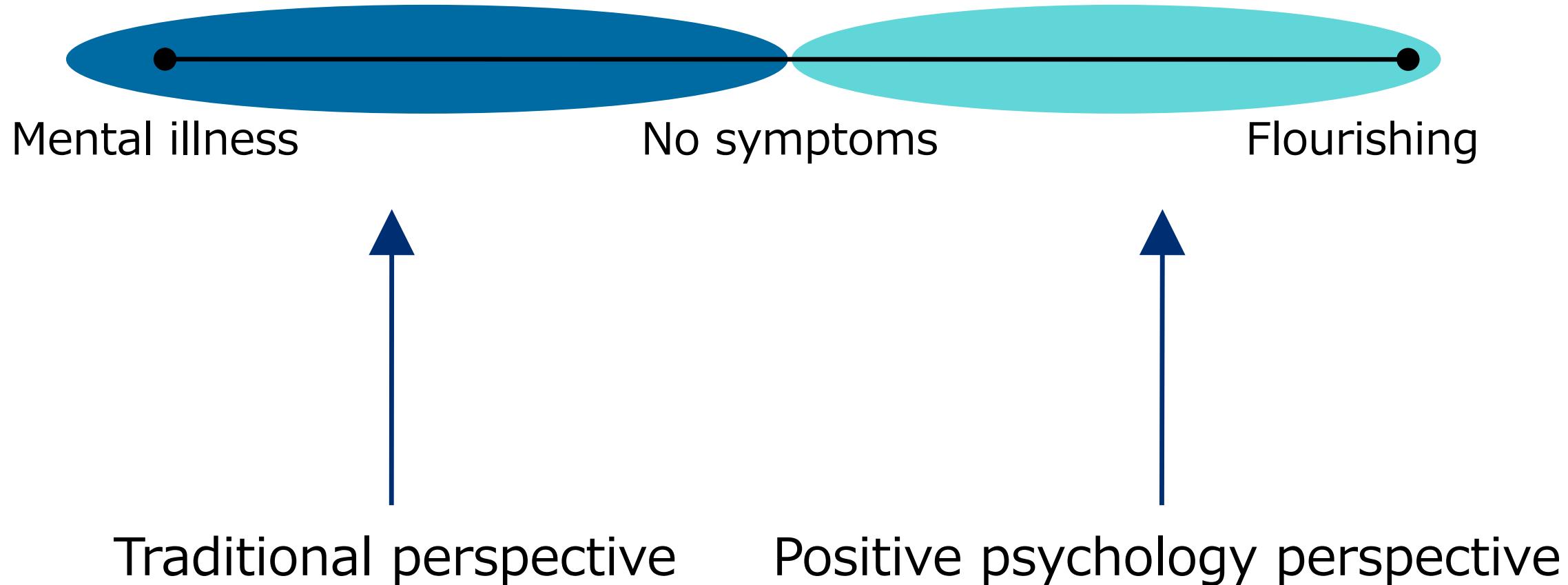
**Martin E. P. Seligman**

[https://commons.wikimedia.org/wiki/File:Flickr\\_-\\_The\\_U.S.\\_Army\\_-\\_Comprehensive\\_Soldiers\\_Fitness\\_\(1\)cropped.jpg](https://commons.wikimedia.org/wiki/File:Flickr_-_The_U.S._Army_-_Comprehensive_Soldiers_Fitness_(1)cropped.jpg)

# What is positive psychology?

- “The **scientific study** of optimal functioning that aims to discover and promote factors that allow individuals and communities to thrive.”

# Change in perspective



# Aims of positive psychology

## Is it simply a sense happiness or something more?



Flourishing = “The experience of life going well…feeling good & functioning effectively”



Peggy Kern, Presentation in Kanazawa, 2014



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# From a Pathology Model to a Happiness Model

DSM: *Diagnostic and statistical manual of mental disorder*  
(American Psychiatric Association, 1994)

- Diagnostic manual for human psychological disorders and dysfunctions

CSV: Character Strengths and Virtues: A handbook and classification (Peterson & Seligman, 2004)

- Diagnostic manual for human character strengths
- Distinguishes six virtues with 24 character strengths categorized within those virtues. The six virtues include wisdom and knowledge, courage, humanity, justice, temperance, and transcendence. Some of the strengths classified under those virtues include originality, love of learning, integrity, diligence, fairness, modesty, and prudence.

## The Relationship between Quality of Life, a Subjective Level of Satisfaction, and Prefrontal Area Activity

Research News

Clarified using near-infrared spectroscopy

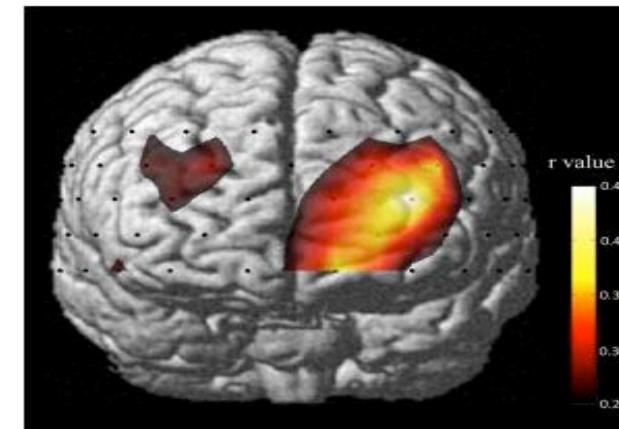
Tags: well-being, biomarkers, quality of life, brain imaging, near-infrared spectroscopy

The University of Tokyo Hospital

2014/01/27

In recent years, there has been an emphasis on not just treatment of illness and extending life, but also on the improvement of subjective levels of satisfaction with quality of life (QOL). However, there is no clarity as to how brain function is involved in subjective QOL formation.

For a group of professors, including Kiyoto Kasai of the Psychiatry Department of the Graduate School of Medicine and Faculty of Medicine at the University of Tokyo, to clarify the psychological foundation behind subjective QOL, they examined the relationship between prefrontal area activity and subjective QOL among 72 healthy people using 52 channel near-infrared spectroscopy (NIRS). Concretely speaking, brain activity was measured using NIRS for these 72 people when they listed words matching conditions (ex. Words beginning with "a") presented within a certain time period (1 minute) (word fluency problems). Word fluency problems are also used as a psychological test, measuring the ability of people to process and produce words. Results showed that frontal area activity during the word fluency problem test increased with subjective QOL for healthy people. It also became clear that, for subjective QOL, the physical and social relationships level of satisfaction is related to stronger prefrontal activity. These results suggest that prefrontal area functioning plays a crucial role in forming subjective QOL. Also NIRS has the advantage of being simple and easy, and provides the ability to measure brain activity in a natural body posture from outside without injuring the brain. Brain activity data obtained using NIRS may be used as a biological indicator of subjective QOL.



Yoshihiro Satomura, Kiyoto Kasai. Places in the brain where high activity was recognized during word fluency problems in a group with high subjective QOL (significant statistical correlation between QOL level of satisfaction and brain activity)

## Subjective Level of Satisfaction and Brain Activity

<http://www.u-tokyo.ac.jp/ja/utokyo-research/research-news/subjective-qol-and-the-brain/>

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## 研究成果

### Research Results

#### Elucidating the Neurological Foundations of Happiness

November 20, 2015

A research group, including the Graduate School of Medicine's associate professor Wataru Sato, conducted a paper-based survey examining the ability of magnetic resonance imaging (MRI) to measure brain structure and levels of happiness with respect to the psychological foundations of subjective happiness. The results showed a positive relationship between gray matter volume in the right hemisphere precuneus (region on the inner surface of the [illegible] lobe) and subjective happiness. This means that this region is larger in those experiencing stronger feelings of happiness. They also showed that this right precuneus is related to the strength of pleasant and unpleasant feelings and integrated indices of life goals. That is to say, this region is large in people with strong positive emotions and weak negative emotions who can easily find meaning in life. In summary, the results suggest that happiness is a subjective experience in which emotional and cognitive information is integrated and created in the precuneus. This is the first time anywhere in the world that the structural psychological foundation of subjective happiness has been clarified.

The results of the research were published on November 20, 2015, on the U.K.'s Scientific Reports website.

Comments from the researcher



I am happy that I could provide my own scientific answer to the question of "What is happiness?" that preeminent scholars, such as Aristotle, have grappled with.

佐藤特定准教授

# Example of the Application of Positive Psychology

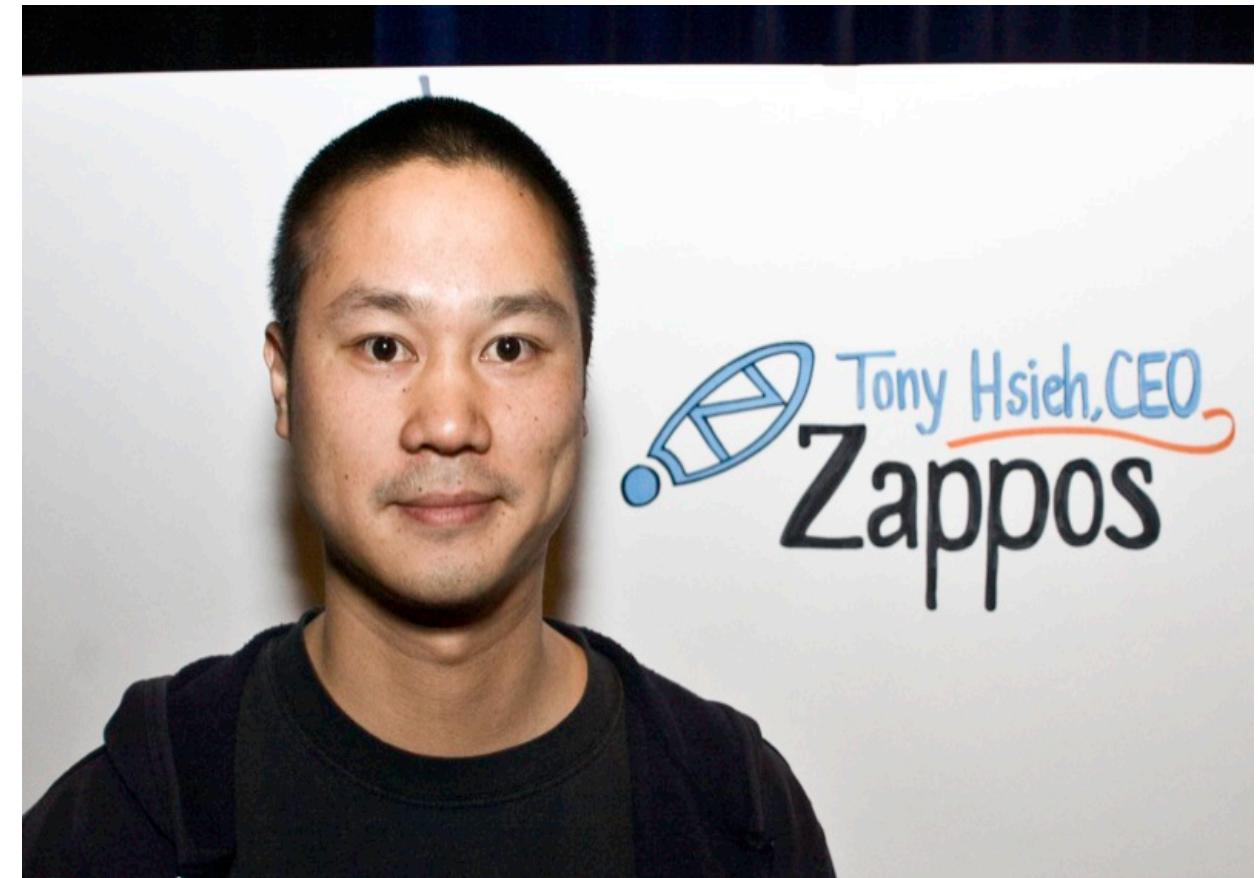
U.S. Army Comprehensive Soldier and Family Fitness (CSF2) Program:  
5 Dimension Fitness

- Physical
- Emotional
- Social
- Family
- Spiritual

# Example of the Application of Positive Psychology

## Basic Values of Zappos

- Deliver WOW Through Service
- Embrace and Drive Change
- Create Fun and A Little Weirdness
- Be Adventurous, Creative, and Open-Minded
- Pursue Growth and Learning
- Build Open and Honest Relationships With Communication
- Build a Positive Team and Family Spirit
- Do More With Less
- Be Passionate and Determined
- Be Humble



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**Google**

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***Search Inside Yourself: The Unexpected Path to Achieving Success, Happiness (and World Peace) by Chade-Meng Tan, Daniel Goleman, Jon Kabat-Zinn (HarperCollins: 2012)***

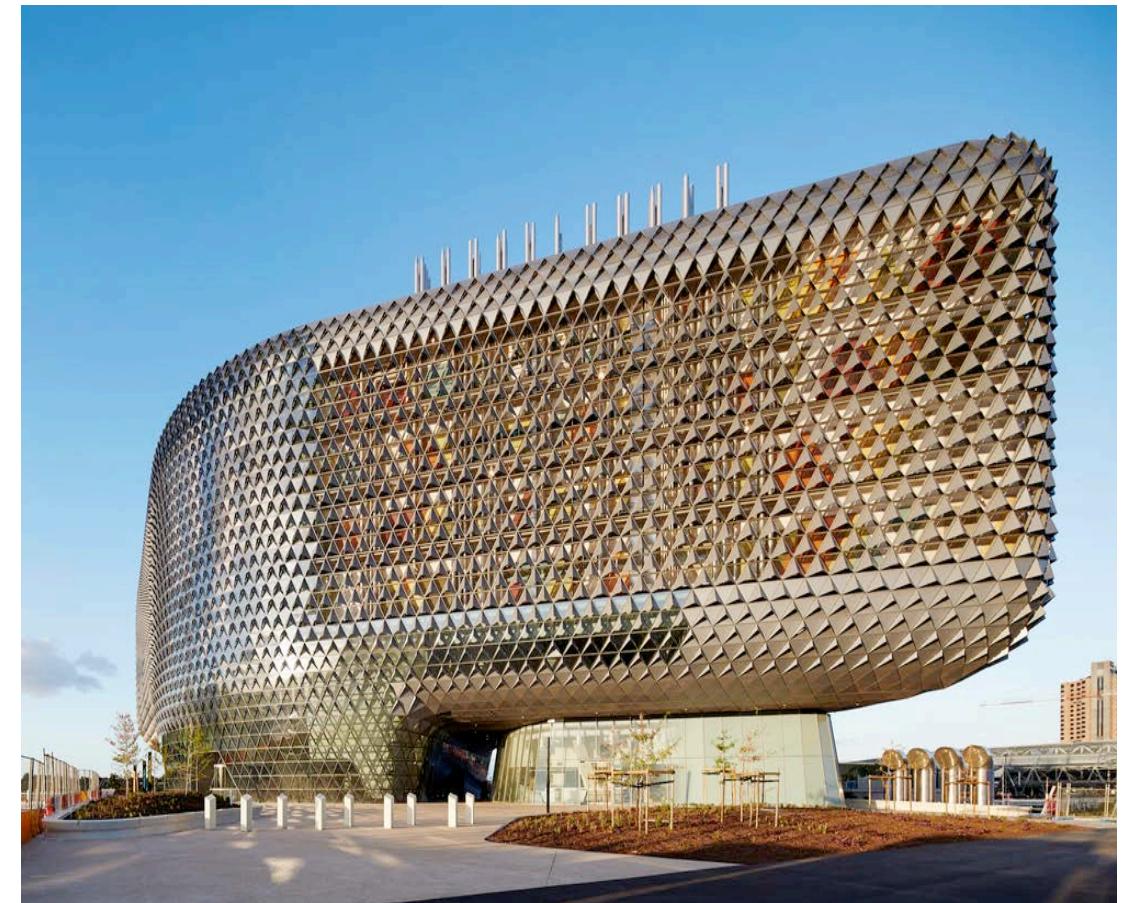


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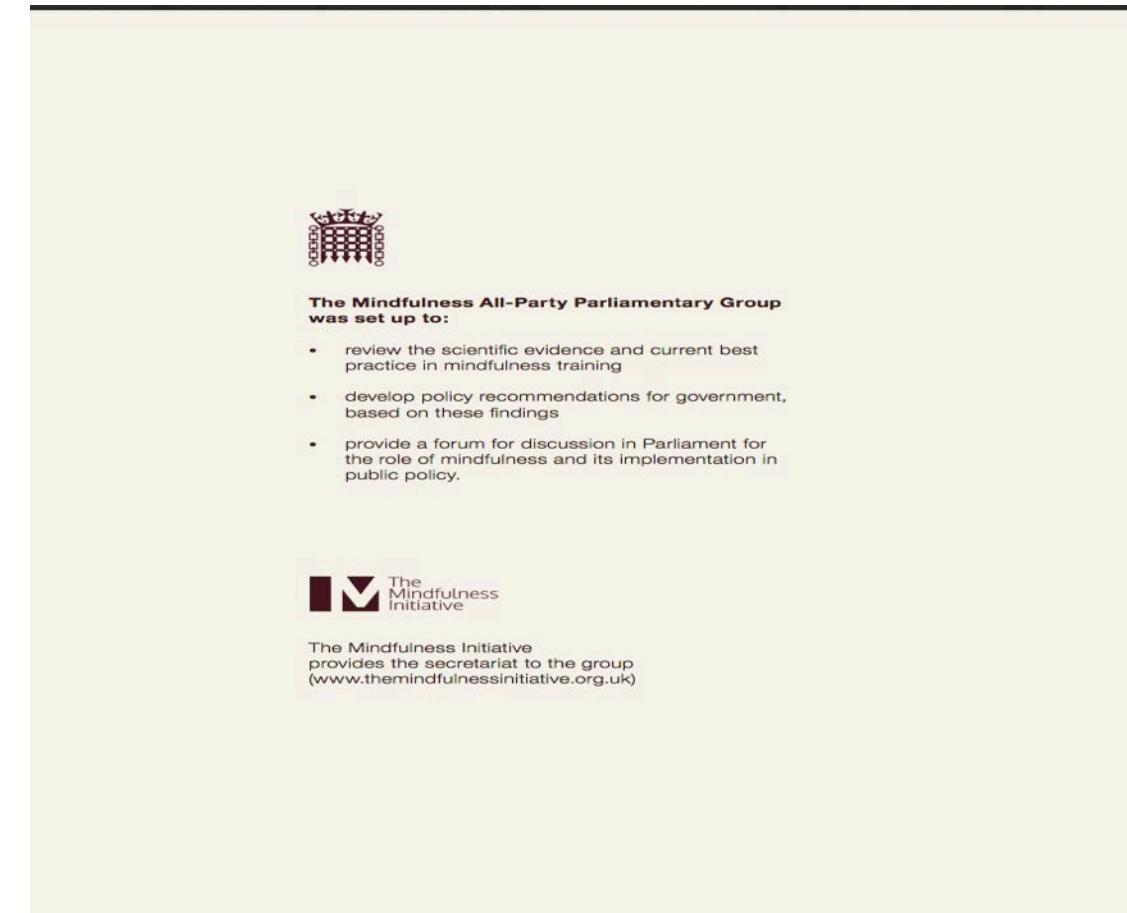
State of South Australia, Australia  
(Capital: Adelaide)

- Program to invite educated people (Martin Seligman)
- Well-being and positive education
- St. Peter's College
- South Australian Health and Medical Research Institute "spirit and body program"



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# Mindful Nation (UK government report) (October 2015)





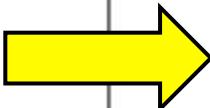
**United Nations' International Day of Happiness  
March 20th**

UN Photo/Andrea Brizzi

[http://www.unmultimedia.org/photo/detail.jsp?  
app=1&lang=en&id=846/84621&key=89&query=UN%20landmark%20building&lang=en&sf=](http://www.unmultimedia.org/photo/detail.jsp?app=1&lang=en&id=846/84621&key=89&query=UN%20landmark%20building&lang=en&sf=)  
<http://www.un.org/en/events/happinessday/>

# UN Ranking of Happiness: 2013-15

## Japan is 53rd ! Denmark is 1st.

- 
- 49. Uzbekistan (5.987)
  - 50. Italy (5.977)
  - 51. Ecuador (5.976)
  - 52. Belize (5.956)
  - 53. Japan (5.921)



- |  |   |
|--|---|
| ■ Explained by: GDP per capita               | ■ Explained by: generosity                |
| ■ Explained by: social support               | ■ Explained by: perceptions of corruption |
| ■ Explained by: healthy life expectancy      | ■ Dystopia (2.33) + residual              |
| ■ Explained by: freedom to make life choices | ■ □ 95% confidence interval               |

# Carol Ryff: Psychological Wellbeing



# Tom Rath: Holistic Wellbeing

Holistic view of wellbeing over a lifetime:

- Career wellbeing
- Social wellbeing
- Financial wellbeing
- Physical wellbeing
- Community wellbeing

# Martin Seligman: Flourishing

Wellbeing has five measurable elements:

**P**ositive emotion

**E**nagement

**R**elationships

**M**eaning

**A**chievement

# Science and Engineering Ethics 2.0

## Basic Principle of Engineering Ethics and “Well-being”

Basic principle of engineering ethics  
Contributions to public safety, health, and well-being



Individual happiness (well-being): Meaningful life: Obtaining the greatest and longest-lasting subjective well-being by working toward and contributing to something larger than one's self.



In other words, engineers bring increased well-being to society and happiness (well-being) to themselves by working ethically.

# Summary

- Ethics involves both considerations and actions that must be performed to achieve well-being, namely to live well.
- The ability to apply ethical (particularly aspirational ethics) knowledge and judgment are not peripheral abilities for people involved in science and engineering. Rather, they are core aptitudes and abilities (OS) for creating one's own meaning of existence.

# Summary

- Basic ethical principle of scientists and engineers include contributing to the safety, health, and well-being of the public and, according to positive psychology, obtaining the greatest and longest-lasting subjective happiness (increasing well-being) through meaningful work (working toward and contributing to something larger than one's self).
- In other words, scientists and engineers increase societal well-being and generate their own happiness by working ethically. (Thus, they can live well.)