

Seeking a World Where Everyone Can Play Sports with Everyone:

the Vision of Keio Media Design (KMD)

By Minato Takeda & Masahiko Inami



The concept image of "Superhuman Sports"

Sports, Body & Technology

What is the first thing you think of when you hear the word "sports"? Bodies in action, the white heat of competition, light exercise to stay healthy? Much depends on your relationship with sports in your daily life, but "technology" is not what comes to many minds.

Since ancient times, sports have played a role as a kind of field of battle where the potential of the human body is explored and personal limits are challenged in competition against others. Foremost among the venues are the Olympic Games, the world's greatest sports festival, where fine-tuned bodies and sharply honed skills and intellect are pushed to their limits in pursuit of the ultimate — a true manifestation of the essence of the human race. The world records and gold medals are proud evidence of the indomitable spirit of mankind.

But science and technology, at first glance diametrically opposed to sports, serve as the backdrop for these emblems of glory. Fresh in our memories regarding the nexus of science and technology and sports is the controversy during the 2008 Beijing Olympics over competitive swimsuits. The LZR Racer swimsuits developed by Speedo enabled wearers to achieve significant improvements in lap time by minimizing water friction by using new material for the swimsuit surface and by squeezing the body tightly. Many swimmers wore LZR Racers at the competition, resulting in a bonanza of 25 new world records. This led to a change in the swimsuit regulations for official meets with the banning of these swimsuits as of 2010, generating a new round of headlines about the controversy. But the iconic moment came in the 2012 London Olympics, when Oscar Pistorius, a double amputee below the knees, became the first athlete to compete in the Olympics with artificial legs and shocked the world by running competitive heats against the world-class competition. This year, Markus Rehm, who has one leg amputated below the knee, won the long-jump on July 26 in the German Athletics Championships, beating his able-bodied competitors.

Today, progress in sports cannot be divorced from science and technology. The power of science is all-pervasive, in training, broadcasting, and body parts such as artificial limbs, not to mention sports equipment and the stadiums and other facilities. We do not need to be reminded by the example of Pistorius's historic run to see that the day is near when the power of science will surpass that of

the human body. Paralympic records may very well surpass Olympic records in at the 2020 Tokyo Games.

Surpassing Humans through Science & Technology



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This "encroachment" by science and technology is a highly sensitive issue for sports, whose purpose is to challenge the limits of the human body. But another way of looking at this is as an opportunity to transcend the limits of the human body.

At the Graduate School of Media Design (KMD) at Keio University, the authors run the Reality Media Project, which brings together science, engineering and physiology to conduct research on "virtual reality" (VR), which artificially generates sensations that are identical to those in the real world, and "augmented reality" (AR), which expands the real world using virtual reality. One area that we have been focusing on is the "augmented human" (AH) — using science and technology to reinforce and expand human capabilities. AH technology makes it possible to do things that ordinary humans could never do, such as "galvanic vestibular stimulation" (GVS), which manipulates the sense of balance through electric stimuli, the "telexistence" robot TELESTAR, which enables a person to project himself or herself to distant places by synchronizing touch, vision and movement, and the "Stop Motion Goggle", which enables the wearer to see an object traveling and/or spinning at high speed as if it were at a standstill.

At KMD, we are working to use human enhancement technology to create "Superhuman Sports" — a new world of sports in which the fusion of humans and machines enables everyone to compete on a level playing field as a "superhuman".

The Concept of Superhuman Sports

Taking place beyond the limits imposed by the human body, superhuman sports have one or more of the following three characteristics.

First, new sports that only existed in the imagination can actually be experienced. For example, the sky can be used as a playing field with small multicopters equipped with cameras. This will enable us to experience real world air sports similar to Quidditch in the Harry Potter series. Robot soccer games that members of the crowd can join on the fly will become possible with the use of telexistence technology.

Second, the superhuman powers provided by science and technology will erase the gap between individual physical abilities, enabling anyone to enjoy sports with each other. The massive strength of powered exoskeletons will minimize differences in gender- and age-related physical dimensions and muscular strength, while enhanced dynamic visual acuity making the trajectories of a ball visible will enable rank amateurs to hit it back against the pros. The time may come when the wall between the handicapped and able-bodied will break down under the force of high-performance robotic prosthetics and gadgets.

Finally, science and technology can be applied to training. Appropriate use of biometry and gamification techniques will make effective and enjoyable training that fits the physical characteristics of the individual and the nature of the sport possible.

In short, superhuman sports reveal a new dimension in the world of sports where all people, athletic or not, children or elderly, able-bodied or handicapped, professional or amateur can all enjoy playing together.

KMD is hosting events and conducting research to make superhuman sports a reality (*Photo 1*).

Superhuman Sports Exhibition

On Feb. 28 and March 1, 2014, the Superhuman Sports Exhibition was held as part of the KMD Forum, an open-day event hosted by KMD. The exhibition, the inaugural event of superhuman sports, featured 14 demonstration projects regarding expansion in four categories — physical capabilities, sports equipment, playing fields, and sports spectatorship — based largely on research conducted by KMD but also by outside laboratories and businesses engaged in research related to superhuman sports.

Six research projects on the expansion of physical capabilities were represented, of which three — “Skeltonics” (Skeltonics, Inc.) (*Photo 2*), a nearly 3-meter exoskeleton that mirrors the physical movements of the wearer; the prototype of a robotic artificial leg equipped with motors and electronic circuits that is on the verge of surpassing the human leg (Ken Endo, at Sony CSL); and “ACSIVE” (Sano Laboratory, Nagoya Institute of Technology), a body-mounted walker that functions without a power source — act directly on the human body, while the other three — “Spider Vision” (KMD), a visual field-expansion system that allows the user to see both front and back simultaneously, and the aforementioned Stop Motion Goggle and GVS — enable the expansion of the senses such as vision and balance, demonstrating the potential for expanding both the physical body and the senses.

PHOTO 2

Photo: KMD



Pictured is a demonstration of “Skeltonics”, a scene from the Superhuman Sports Exhibition.

Expansion of sports equipment was represented by “TAMA” (Nojima Laboratory, University of Electro-Communications), a ball with a pressurized air cylinder and sensor making it possible to change trajectory in mid-flight as if by magic. When the ball is lightly tapped just before being thrown, it releases the air at the apex of its flight, which changes its course.

On the open-air veranda outside the exhibition hall, three research projects on developing air sports using quadcopters and head-mounted displays were presented: “Flying TELUBee” (KMD), “Flying Sports Assistant” (Rekimoto Laboratory, University of Tokyo), and “Hiyoshi Jump” (jointly presented by Unity Technologies Japan G.K. and KMD). Flying TELUBee is equipped with two cameras, one for each eye, offering 3D vision that gives the wearer the sensation of flight (*Photo 3*). Increasing the distance between the two cameras has the same effect as increasing the distance between the physical eyes of the user, providing him or her with the sensation of becoming a giant.

For expanding sports spectator experience, we attempted to reimagine “watching sports” from perspectives different from ordinary TV broadcasts or live viewing with “Haptic Broadcast”

PHOTO 3

Photo: KMD



(KMD), which conveys the physical sensation of hitting a shuttlecock with a badminton racket as well as the visual image; “RePro3D” (KMD), which enables the user to see 3-dimensional images from any angle without using glasses; “TORSO” (KMD), which moves just like the user’s head, enabling him or her to freely look at distant objects; and “AuxDeco” (EyePlusPlus, Inc.), which enables the visually-impaired to “see” through stimuli on the forehead.

Symposium on “Augmented Sports”

We held a 90-minute panel discussion on March 1 in conjunction with the Superhuman Sports Exhibition. Six experts from a wide range of areas including technology and policy, culture, psychology and rehabilitation engineering came together to debate the potential for expanding sports through science and technology with Masahiko Inami (KMD) as moderator. Brief as the event was, the panelists shared their respective visions for the future and engaged each other in an enthusiastic debate.

In introductory remarks opening the session on this new undertaking of superhuman sports, Inami expressed his hopes for creating a major event in conjunction with the 2020 Tokyo Olympics that would bring together technology, sports and culture to transcend the difference between the Olympics and the Paralympics. The event would feature competitions aimed at being the best of their kind in the world, but the ultimate objective would be to enable everyone, young and old, men and women, amateurs and pros to participate, including cheering squads and spectators, as well as engage in related cosplay and installations.

This was followed by each of the panelists giving an account of his background, current work and future prospects, as follows:

Koki Uchimaru (director at the Research and Development Bureau, Ministry of Education, Culture, Sports, Science and Technology) has worked on science and technology issues concerning multimedia and digital contents promotion. Currently, he is in charge of government support for research and development that promotes spiritual enrichment, with the Tokyo Olympics as a major focal point. He expressed his interest in undertakings such as superhuman sports as a means to reinvigorate Japanese society by mobilizing its underlying strengths, and its cultural and technological prowess.

Ken Endo (Sony CSL), whose robotic legs were on view at the Superhuman Sports Exhibition, referred to his research on prosthetics and offered his thoughts on the relationship between technology and the human body. He explained that he was conducting research under the view that artificial limbs would no longer be a disadvantage as science and technology progressed and in fact could provide an edge as they expanded the human body. Besides these high-end artificial limbs, he was also conducting research on low-cost artificial limbs for people in developing countries who needed them but were not able to afford them.

Eiichi Ono (director of the Department of Rehabilitation Engineering, National Rehabilitation Center for Persons with Disabilities), recounting his migration from research in robotics to

welfare, outlined R&D on artificial legs for sports and equipment for supporting self-reliance, explaining the lack of information on the actual needs in this field and emphasizing the need to establish an environment conducive to creating truly appropriate devices.

Takaaki Kato (Keio University SFC) drew on his own athletic experience to talk about psychological phenomena regarding concentration and the senses while exercising, and then explained how the conditions of athletes were tracked and analyzed using sensors and other devices.

Ichiya Nakamura (KMD) used the wearable devices, on which extensive research had been conducted at the MIT Lab but took more than a decade to become widely used, to emphasize the importance of design in science and technology. He drew on his research on media policy and pop culture to point out that it would become important in the future to make full use of the “Cool Japan” manufacturing skills if these devices were going to be widely used.

Finally, Junichi Rekimoto (Tokyo University), whose research focuses on real world-oriented interfaces that directly transform real-world objects into sensors and actuators, proposed as new avenues for merging technology and sports the development of new worldviews by generating phenomena that normally would not occur naturally such as the “magic pitch” and the expansion of activities surrounding the game itself by providing information to spectators with AR and digitalizing training. He went on to introduce a coaching system that shifts the player’s perspective away from his or her spatial location, enabling the player to see himself or herself objectively.

These introductory comments were followed by discussions on how we should be going about creating the future in the lead-up to 2020, exploring in detail the technological and social issues confronting the panelists and confirming the importance of finding the right time and place to introduce new technologies, not to mention their development itself. A Q&A session ensued, receiving comments from neuroscience authority Naotaka Fujii (Riken Brain Science Institute) and media artist Kazuhiko Hachiya among others, after which we closed the session joined by over 100 enthusiastic audience members.

Superhuman Sports as Welfare of the Future

Sports means many things, but superhuman sports have just as much if not more significance, as the Superhuman Sports Exhibition and the Augmented Sports symposium demonstrated. Welfare is a major subject here. The right to play sports was first explicitly recognized under the Basic Act on Sport, enacted in 2011. The law guarantees that every individual has an equal right to enjoy sports. Creating a society where “everyone, anytime, anywhere, can enjoy sports all lifelong” as a means of health maintenance, entertainment and communication through “lifelong sports” had been a government objective even before the law was enacted. Particularly in Japan’s aging society, there has been growing demand for and interest in sports, not as contests of victory or defeat but as a form of welfare.

Superhuman sports, with the addition of “with anyone” to the lifelong sports concept, have incorporated this element of accessibility from the very beginning. To show the way of a future where everyone can play sports with anyone, KMD is cohosting “Exhibition 2020 Shibuya: See How Super-welfare Feels as an Everyday Experience” with the People Design Institute based in Shibuya. The institute is a nonprofit organization whose aim is to develop creative solutions for bridging gaps generated by gender, the body, language, race and other factors. We are cooperating to hold a one-week exhibition at Shibuya Hikarie multipurpose high-rise tower, using one day during that week for events and a symposium featuring experts. Unlike conventional welfare exhibitions, whose main purpose is to display assistive products for users and people working in the sector, the exhibition aims to build hope for a community of the future where “super-welfare” is a reality by staging the undertaking in Shibuya, a hotbed of youth culture, and demonstrating not the assistive products *per se* but the lifestyles and everyday activities incorporating these products.

Conventional welfare compensates for disabilities to bridge the gap between the handicapped and the able-bodied. “Super-welfare” is the next stage in welfare in which technology is used to raise both the handicapped and the able-bodied to attain similarly higher levels. Eyeglasses are a good example. Once a heavy, cumbersome and ungainly visual aid, technological advances have so improved the eyeglass that people with normal eyesight want to wear it as a fashion item. Increasingly rapid scientific and technological progress is about to take prosthetics and motile walking aids to that stage.

KMD will use the super-welfare Exhibition to bring to life a future vision of Shibuya from the two perspectives of fashion and sports. There will be an unprecedented fashion initiative in which models with artificial limbs embodying a different beauty intersect with able-bodied cosplayers in outfits that apply the artificial limb technology.

Superhuman Sports Athletic Meet 2020

KMD continues to expand the reach of superhuman sports through these exhibitions and events, but our most ambitious goal is of course to hold a superhuman sports festival in parallel with the 2020 Tokyo Olympics.

Many organizations focusing on sports of the future are being launched this year, perhaps inspired by the award of the Olympic Games to Tokyo. In Japan, Hiroshi Inukai, the e-sports producer of the Sports Time Machine installation, which enables people to race against past records and even animals, has set up the Sports Meet Department Subcommittee of NicoNico Gakkai Beta to design and create the sports meet of the future. Prosthetic designer Ken Endo has teamed up with former Olympic hurdler Dai Tamesue and product designer Anri Sugihara to form Xiborg Co., Ltd. to conduct research and development on prosthetic devices for athletics. Overseas, Cybathlon, a championship for disabled athletes using electronically-controlled artificial limbs, brain-computer interfaces and other advanced technologies, is in the works. It is easy to

imagine that this trend will only accelerate over time.

On Oct. 10, commemorating the 50th anniversary of the 1964 Tokyo Summer Olympics, KMD established the Superhuman Sports Committee in cooperation with these organizations in order to launch a major event on the occasion of the 2020 Tokyo Olympics. The committee is already acting to create this superhuman sports festival that will merge sports science and culture through proposals for rules for new sports, expansion of training activities, spectator experience and the relevant human resource development and policy proposals, not to mention technology development. Researchers in the AH, sports engineering, human engineering, entertainment and cultural policy disciplines as well as artists and game designers have come together to participate as one in this exhilarating endeavor to carve out our future.

The annual National Sports Festival in Fukui Prefecture in 2018 will present a major milestone. Fukui, as the location of the city of Sabae, the largest producer of eyeglasses in Japan, intends to host a “Wearable National Sports Festival” at the technological cutting edge that incorporates a wide variety of wearable devices. We want to help superhuman sports develop by collaborating with these and other events.

Sports, Technology & Culture

Finally, we need to figure out how to position these new undertakings and present them to the Japanese public and the global community. The key here is Japan’s cultural power.

Japan is often contrasted with the West in regard to visual works and the robotic industry for its much greater affinity between humans and machines. In the West, robots obey, help and serve humankind, as can be seen from the origin of the word (it was coined by the Czech writer Karel Capek in 1920 from the word *robota*, literally meaning “forced labor”) or Isaac Asimov’s *Three Laws of Robotics*. By contrast, the Japanese image of the robot is epitomized by Astro Boy, partner to humanity, an entity with a soul. Dr. Tenma built Astro Boy to replace the son that he had lost in an accident, not as a source of labor to exploit. Even today, mainstream developmental work on robots focuses on warfare overseas, while it is concentrated in entertainment and nursing care in Japan, where ASIMO, whose only functions are walking and talking, enjoys immense popularity.

That is why we believe that Japan will be the source of creations that best embody the spirit of a new era in which humans and machines merge.

For starters, why not watch *Ghost in the Shell* and *Cyborg 009* together and let our imaginations run free?

For more information: <http://superhuman-sports.org>

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