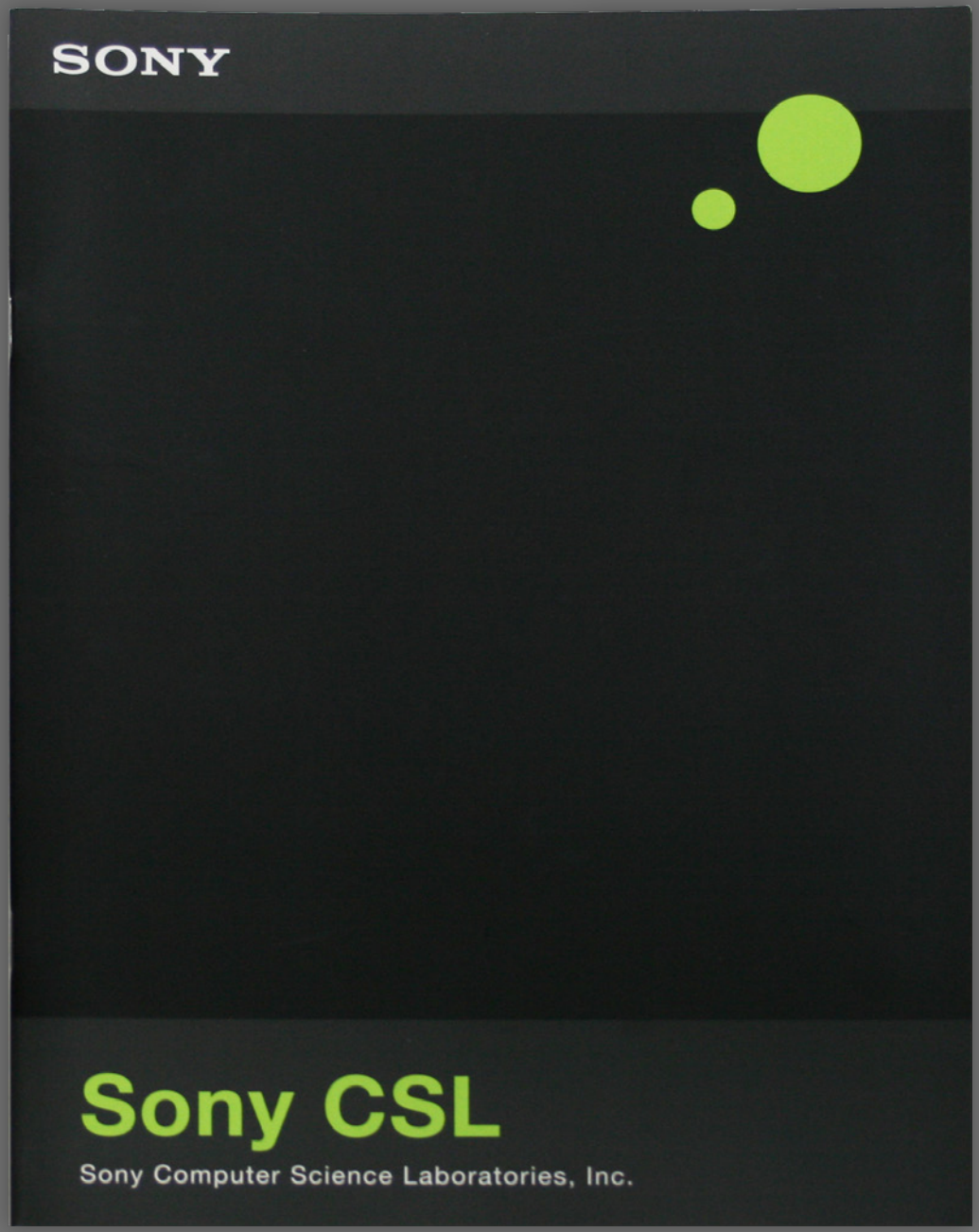
SONY
Sony CSL
Sony Computer Science Laboratories, Inc.

Sony CSL

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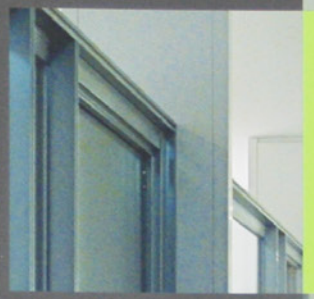


Message from President

所 眞理雄　Mario Tokoro

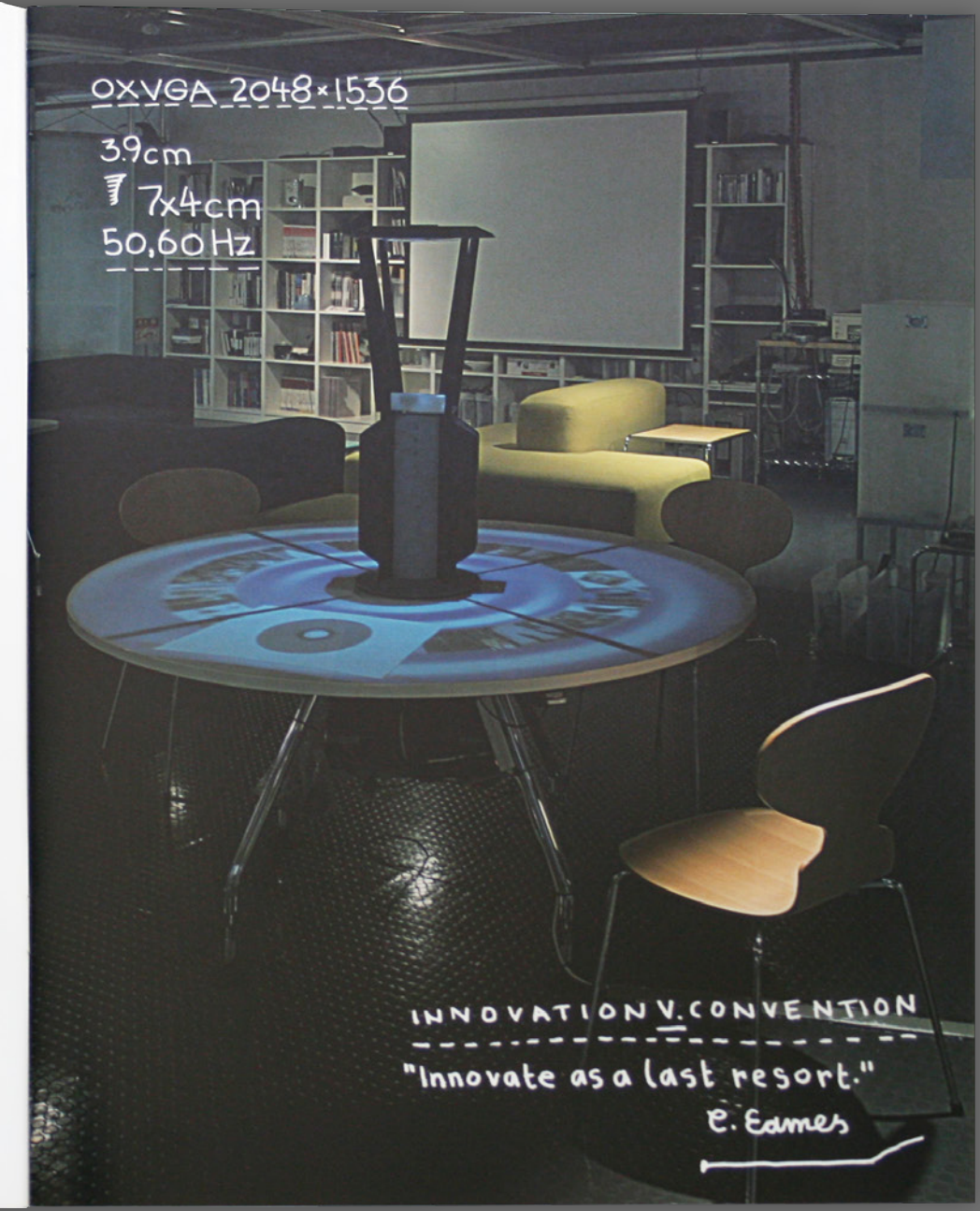
ソニーコンピュータサイエンス研究所 代表取締役社長
ソニー株式会社 特別理事

President, Sony Computer Science Laboratories, Inc.
Senior Research Fellow, Sony Corporation.

好きな研究をしてよいと言われたとき、あなたは意義のある研究ができるでしょうか？研究には、常識にとらわれず高い理想を掲げる構想力と、現実を見すえる厳しい眼の両方を持つことが必要です。そして遠い将来に向けて理想と現実の橋渡しをすることが研究者の任務ですが、決して容易に成し遂げられることではありません。しかしそれを達成する能力があり、意欲に満ち、しかも自由の重みを知っている研究者は、いまや最高の研究環境を得る権利があると考えます。

この研究所は研究者にとって最も望ましい環境を提供するとともに、個人の自由意志を尊重し、新たな研究分野を開拓し、単なる模倣や改良に終わらない真に創造性にあふれた研究活動を行うために設立されました。そして、それを通じて真の意味で国際社会に貢献することを目標としています。

Research, in the true sense of the word, is to set a high ideal based on a full understanding and critical view of the existing state of technology, while striving for a new approach to bring it to reality. The Sony Computer Science Laboratories are the place for those aspiring researchers who know what research really means. We search for the technology that will prove its worth even in the years ahead. Our work is unrestrained by commercial needs. With the policy of bringing out the best in individuals, we respect and foster each member's initiative and creative ability. We contribute to the world by creating new possibilities for tomorrow.



Sony Computer Science Laboratories

ソニーコンピュータサイエンス研究所

ソニーコンピュータサイエンス研究所（Sony CSL）は、長期にコンピュータサイエンスに関する研究を行う場として1988年2月に設立されました。当時の設立趣意書には、「来るべき21世紀に照準 を合わせた、コンピュータの歴史に残りうる価値を持った独創的な研究を行い、これによって広く社会・産業の発展に貢献するところにあります。」とあり、研究テーマは (1) 分散オペレーティングシステム、(2) コンピュータネットワーク、(3) プログラミング言語、(4) ヒューマン・コンピュータ・インタラクションなど次世代を担うコンピュータシステムの基礎を担うものが中心でした。

その後、設立趣意の精神を受け継きつつ、コンピュータサイエンスを広義に捉え、複雑系、脳科学、システム生物学、エコノフィジックスなどを研究テーマに加え、相互に影響を与えつつ新たな価値創造に向けて幅広く研究活動を展開しております。

研究者は、この研究所の基本的な研究テーマに基づいて、ひとりひとりが自分自身で目標を立てて研究を遂行します。そして、その研究成果である論文や研究用 ソフトウェアなどは、すべて研究者個人の名において発表されることになります。これは、当研究所が、研究とは本来、個人あるいは個 人の自由意志に基づく集団が自発的に行うもので、研究所はそれをサポートする存在に徹するべきだと考えているからです。また個人の業績は著書、論文、研究用ソフトウェア開発、国内・国際学会における活動、特許や商品への貢献などを対象に、目標を達成した水準に従って正当に評価されることになります。そのため、給与体系は年功序列とはまったく無縁であり、個々の研究業績に十分に相応した報酬が支払われるシステムを採用しています。

The Sony Computer Science Laboratories (Sony CSL) were founded in February 1988 for the sole purpose of conducting research relating to computer science. Our objective, as stated in our mission statement, is "to contribute extensively to social and industrial development through original research that looks ahead to the 21st century and has the potential to achieve breakthroughs in computer technology." It is our policy to make public the results of our research. In the first decade after the company's founding, we have been focusing on research in distributed operating systems, computer networks, programming languages, human-computer interaction, and other fundamental aspects of cutting edge research.

While the spirit of the original intent is still valid, redefining computer science in a broader sense, we are now expanding our areas of research further into complex systems, brain sciences, systems biology, and econophysics; all areas are inspiring our researchers to bring new insight into work done on technology of the future. Each member of Sony CSL sets his or her own research goals within these fundamental research themes. Results in any form such as books, research software or technical papers, are published under the names of the individual researchers. This is because we believe that individuals using their own initiative or motivated individuals within a spontaneously formed group produce the best work, and that a laboratory should be a place dedicated to supporting this activity. The results achieved by each member are evaluated through such froms as books, technical papers, research software products, international conferences, patents and contribution to products.

History and Achievements

歴史と成果

ソニーコンピュータサイエンス研究所は1988年2月に創立され、同年4月に東京で 稼働を開始しました。その後、オブジェクト指向分散オペレーティングシステム Aperios、計算場モデル、移動ホストプロトコルVIP、プログラミング言語、仮想三次元標準記述言語VRMLやブラウザー Community Placeへとつながるバーチャル・ソサエティーの概念、エージェント指向インタフェース、マルチエージェントシステム、実世界指向インタフェース NaviCam、拡張現実感、認知ロボット等に関する研究と開発を行い、各方面から高い評価を得てきました。そのうちの多くの技術は本社へ移管され、各種製品に活かされ、また国際標準化にも貢献して来ました。

最近では、システムバイオロジーやシステム脳科学、エコノフィジックスなどの新たな学問分野の創生に深くかかわり、基礎科学への貢献も認知されるようになりました。研究活動の国際化と多様性を拡大するために、1996年の10月にはフランスのパリに研究所を新設し、認知機構や進化的システム、計算脳科学の研究を中心に進めています。1999年にはインタラクションラボラトリーを加え、コンピュータと人間とのインタラクションに関して一連の革新的な研究を推進しています。

Sony Computer Science Laboratories were established in February 1988 and became operational in Tokyo in April of the same year. Since then, a diverse range of research and development has been carried out. Examples of achievements include development of the object-oriented distributed operating system, Aperios, computational field models, the mobile host protocol VIP, and programming languages. The concept of virtual society that led to the virtual three-dimensional standard description language, VRML, and the Community Place browser was started here. Agent-oriented interfaces, multi-agent systems, augumented reality, such as the real world oriented interface, NaviCam, and cognitive robotics, all these and more have received strong support from all quarters within the research community as well as industrial sectors.

Many of these technologies have been transferred to Sony Corporation and made components of Sony products, and some have also contributed to international standardization activities. We are currently deeply involved in the creation of new research areas such as Systems Biology, System Brain Science, and Econophysics, and have had our contributions recognized by the fundamental science communities. In order to promote the internationalization and diversification of our research activities, a new laboratory was founded in Paris, France in October 1996, with research focused on cognitive mechanisms, evolutionary systems, and computational neuroscience. In 1999, our Interaction Laboratory was founded for promoting a series of innovative research themes related to the interaction between computers and human beings.

Perspective 展望

ソニーコンピュータサイエンス研究所は開設以来、その一貫したテーマとして「開放系」を掲げています。開放系(open systems)とは閉鎖系(closed systems)に対するものです。これまでの科学技術は問題の領域を定義し、切り取り、抽象化することによって問題を解いてきました。しかしながら、近年我々は定義しき れない問題、切り取ることができない問題を解かねばならない状況に至っています。その一般的な例としては社会、経済現象や生命の問題を挙げ ることができます。コンピュータシステムに関して言えば、インターネットのような巨大システムやユーザインターフェースを挙げることができます。インターネットでは時々刻々ネットワークトポロジーや提供されるサービスが変わり、個々の要素システムについての十分な知識を持っていたとしても全体の振舞が予測できません。また、真に使いやすい利用者環境を提供するためには、利用者すなわち人間について良く知らなければなりませんが、人間は、極めて多元的で、その行動は状況や時間に強く依存し、人間を還元論にのみ立脚して理解し、定義づけようとすることには無理があります。このような大きなテーマに向けて、ソニーCSLは真理探究の研究とシステム実現の研究を同時に行っています。すなわち、サイエンス志向の研究者は実世界を計算するための手段としてコンピュータを最大限に利用し、真理を探究します。エンジニアリング志向の研究者はコンピュータやネットワークを実世界の一部に取り込み、安心して使えるようなシステムを構築します。このような相補的なアプローチを一体として行うことにより、相互に大きな刺激を与え合い、新たな研究領域や研究パラダイムを創生し、新技術を創出します。

ソニー CSLは現在、基盤研究室、インタラクションラボラトリー、CSL-Parisという3つの研究室によって構成されています。基盤研究室(FRL)においては、サステイナブルな開放系の持つ基本的特徴である、ロバストネスというモチーフの基に広範な基礎的テーマを研究しています。またインタラクションラボラトリー(IL)は開放系である人間が、開放系技術とインタフェースする際の問題と可能性を追求しています。さらに、CSL-Parisは、人間を認知・文化的側面から探求しており、これら「三つの柱」によってオープンシステムのサイエンスを展開しています。

Sony Computer Science Laboratories have been proposing 'open systems' as a consistent research theme since its establishment. Here, 'open systems' are used as opposed to 'closed systems'. Conventional technology has so far provided solutions to problems by defining the area of the problem, decomposition of the problem, and abstracting it. However, we now face situations where we have to solve problems that cannot be defined and isolated. General examples include problems related to society, economic phenomena, and life. As for computer systems, huge systems such as the Internet and user interfaces are examples. In terms of the Internet, network topologies and services are constantly changing. Thus, such a system cannot be predicted even when there is enough knowledge about each element system. In order to provide a truly user-friendly environment, it is necessary to learn more about users (i.e. human beings). However, human beings are extremely multi-faceted and their behavior is strongly dependent on the varying situations in which they find themselves. It is impossible to understand and define human behavior based only on a reductionist analysis. In pursuing this larger theme, Sony CSL conducts purely scientific research and application-oriented research concurrently. Researchers pursuing purely scientific research often require massive computing power to discover the truth by "computing the world", whereas researchers working on the latter type of topics exploit computers to implement systems embedded in real-world interactions so that "computers become the reality". Such complementary approaches help researchers inspire each other, and forge new research domains, new research paradigms, and new technologies.

Sony CSL is composed of three Laboratories, the Fundamental Research Laboratory, the Interaction Laboratory, and CSL Paris. In our Fundamental Research Laboratory (FRL), we research broad fundamental themes based on a motif of robustness that is a basic characteristic inherent to a sustainable open system. In addition, our Interaction Laboratory (IL) investigates problems and possibilities that occur when a human being behaving as an open system interfaces with open system technologies. Moreover, CSL Paris is in search of human cognition from a cultural standpoint and is engaging in research on a science of human beings and their culture as a open system.

Sony Computer Science Laboratories

- Fundamental Research Laboratory
- Interaction Laboratory
- Sony CSL Paris

Fundamental Research Laboratory

基盤研究室

基盤研究室(FRL)では、コンピュータ・サイエンス及びコンピュータサイエンスが変革の鍵となる研究 領域を対象とした基礎研究を行っています。これには、システム脳科学、システム・バイオロジー、エコノフィジックスなどの分野をはじめとして、次世代の計算機科学などを担う研究を包含しています。

現在、その中核的テーマとして、ロバスト・システムに関する研究が進められています。細胞や脳から経済、人工物まで、オープンシステムに普遍的に観察される ロバストネスの理解と、それらの知見を基礎にしたロバストな動的適応性を示すシステムの構築法などが、重要なトピックとなっています。基礎研究においては、研究者の個性と志が高水準な研究の原動力であることから各々のテーマや研究者の個性の多様性を受け止める研究環境を備えています。

ここでは、人類の知識の拡大への貢献と、その恩恵としての産業応用という二つの側面において、新たな分野を切り開いていく研究を第一義に考えています。産業的な応用の可能性が高い成果については、ソニー本社への技術移管が行われ、新たな研究分野の構築に繋がると考えられる場合には、CSL内において新しいラボの構築へと発展します。

このようにFRLの運営は、柔軟かつシステマティック、そしてダイナミックであり、自らの手で、歴史を塗り替えていこうという志と強烈な個性を持った研究者のための研究室です。

Our Fundamental Research Laboratory carries out fundamental research directed towards the computer sciences and other research areas where computer science is a key for transformation. That includes not only specific fields like system brain science, systems biology, and econophysics, but also leading research in general computer science for next-generation advances.

Currently, research is being conducted on robust systems as a core subject. Important topics are the understanding of robust systems that are universally observed in an open system. Topics range from cells and brains to economics and man-made artifacts. Understanding principles behind them allows researchers to understand methods for designing systems with robust dynamic adaptability. In fundamental research, as the originality and determination of the researcher are the driving forces for top level research, we are providing a research environment as a net for the originality of the researchers and their themes. Of the two aspects of scientific contribution, expansion of human knowledge and industrial application, we give first priority to research that opens new frontiers. As for results with high potential for industrial application, they are transferred to the Sony Corporation, and, when they are believed to have the potential to establish new research fields, they are developed into a new laboratory within the CSL. As mentioned above, the operation of our FRL is flexible yet systematic and dynamic. We host a laboratory for researchers with strong personalities; they are researchers aspiring to make history through their scientific visions.

北野 宏明 Hiroaki Kitano

取締役副所長 Director

生命の本質を理解するには、劇的に進展している分子生物学の成果を基盤とした「システムとしての生命」の理解が必要になります。私は、システムバイオロジーという学問分野を提唱し、システム・レベルでの生命の原理を探求しています。特に、生命システムの持つ、ロバストネス(頑健性)の背後にある原理、頑健性と脆弱性のトレードオフ、ロバストでありながら進化可能であるアーキテクチュアなどに、中心的な興味があります。

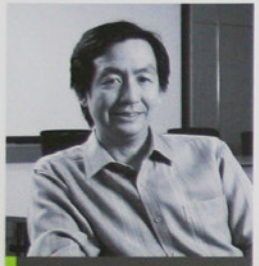
現在、展開中の「生物学的ロバストネスの理論」に基づき、がんなどの主要疾患の予防や治療方法の研究、人工的にロバストなシステムを構築する方法論の確立などに展開しています。

Understanding the fundamental principles of life requires an understanding of living systems as systems. While this should be well grounded in an understanding at the molecular level — and rapid progress in molecular biology has revealed much — a system-level understanding can shed light on some of the deeper principles of life. I proposed "Systems Biology", which is aimed at a system-level understanding of living systems, and am presently devoted to this area of research. A particular focus is the biological theory of robustness, which entails understanding the basic principles of robustness in biological systems, the trade-offs that exist in robust yet fragile systems, and the evolvability of robust systems. Further research now being embarked on involves systems biology in relation to cancer and other major diseases, and the development of artificial systems with highly robust properties.

- Kitano, H. (2004) Biological robustness, Nature Reviews Genetics, 5, 826-837.
- Kitano, H. (2004) Cancer as a robust system: implications for anticancer therapy, Nature Reviews Cancer, 4, 3, 227-235
- Kitano, H. (2002) Systems biology: a brief overview, Science, March, 1; 295 (5560): 1662-4
- Kitano, H. (2002) Computational systems biology, Nature, Nov. 14;420 (6912): 206-10

Fundamental Research Laboratory

Researchers 研究者



高安 秀樹 Hideki Takayasu

地球上の全ての人間の経済活動を記述するために必要な情報量は、一日当たり高高10ギガバイト程度だと推定できます。これは、現在のコンピュータでも収える程度の情報量ですが、人類はまだ、このような詳細で膨大なデータを十分に活用するための科学技術を持ち合わせていません。私が取り組んでいる経済物理学（エコノフィジックス）は、複雑系の科学で培った様々な概念や解析手法を活用して、膨大な現実のデータから有益な情報を導出する目的で生まれた新しい科学の分野です。秒単位で変動する外国為替市場、毎日数十兆円のお金が流れる銀行間の送金関係、100万社以上の企業の統合などに関する基礎研究はほぼ土台ができあがり、実社会に寄与できるような応用研究の芽が伸びています。これらの成果を踏まえた上で、高度に情報化された未来社会での理想的な電子通貨システムも考察しています。

The amount of information describing total global economic activity is estimated to be less than 10 G byte per day. From the viewpoint of computer science this amount of information can feasibly be handled by today's computers. Econophysics is a new science aimed at establishing methods of extracting useful information from high-precision economic data using the concepts and methods developed in the physics of complexity. Foreign exchange markets fluctuating in the order of seconds, the banking system's money transfer network which transacts trillions of yen everyday, competition between millions of companies・・・ basic studies have been established on these topics and my research is now focusing on practical applications. I am also working on designing an ideal electrical currency system for the highly informationalized society of the future.

- 経済物理学（エコノフィジックス）の発見［光文社（2004）］

茂木 健一郎 Kenichiro Mogi

私の究極の目的は、クオリア（qualia）に満ちた意識がいかに脳の神経活動から生み出されるのかを理解することです。このターゲットの実現に向けて、脳の働きをシステム論的に理解するためのさまざまな研究を実施しています。記憶、感情、ボディ・イメージ、視覚、神経細胞の自発的活動、言語、感覚統合、神経経済学などの様々な視点から、システム脳科学の研究を進めています。創造性を支える脳内機構や、セレンディピティ、コミュニケーションといった、人間の認知を支える様々な要素についての斬新な視点に基づく研究テーマを立ち上げ、推進しています。これらの研究から得られた知見を、新しいインターフェイスデザインや、知能システムの構築に応用することも目指しています。

My ultimate goal is to understand the principles that connect neural activity in the brain and our conscious experience, characterized by the richness of qualia. To achieve this goal, I am conducting several research programs aimed at a systems-level understanding of the brain. Themes include memory, emotion, body image, vision, spontaneous neural activities, language, sensory integration, and neuroeconomics. Our group is developing several brand new research themes on the brain mechanisms of creativity, serendipity, and communication. Applications of the insights gained from these research activities to novel interface designs and construction of intelligent systems are envisioned.

- Onzo, A. & Mogi, K. Dynamics of betting behavior under flat reward condition. International Journal of Neural Systems, 15, 93-99 (2005).
- Taya, F. & Mogi, K. Spatio-temporal dynamics of the visual system revealed in binocular rivalry Neuroscience Letters, in press. (2005).

大平 徹 Toru Ohira

私はノイズと相互作用に遅れを含むようなシステムを主として数理的に理解する研究に従事しております。一般には、システムにおけるノイズや遅れはその機能に対する障害と考えられています。しかし自然界、特に生体の情報処理においては、このようなノイズや遅れを克服しているばかりではなく逆に利用している例も見つけられています。私の研究の主眼はそのような自然界の具体例に学ぶ側面と、Delayed Random Walkなどの数理モデルやDelayed Stochastic Resonanceなどの現象概念を構築し提案する側面の、それぞれの展開と融合にあります。これらの研究を通じて、将来の情報処理システムの構築の一助となることを目標としております。

I am investigating the behavior of mutually interacting systems in the presence of noise and delay. Noise and delay are normally considered obstacles to information processing.However, in nature, and particularly in biological systems, there are examples in which noise and delay are taken advantage of for effective information processing. The main focus of my research is the development and synthesis of two aspects of this problem: the study of concrete examples in nature that possess properties capable of exploiting noise and delay, and the development of mathematical models and concepts to describe these systems.- Examples of such models and concepts include "Delayed Random Walks" and "Delayed Stochastic Resonance", I hope that my research will contribute to the future development and achievement of effective open distributed information processing systems.

- 大平徹「遅れとノイズの関近で」数理科学 NO.467 2002年5月号
- Toru Ohira and Yuzuru Sato "Resonance with Noise and Delay", Physical Review Letters, vol. 82, pp. 2811-2815 (1999).
- Toru Ohira and Toshiyuki Yamane "Delayed Stochastic Systems" Physical Review E, vol. 61, pp. 1247-1257 (2000).

フランク ニールセン Frank Nielsen

My research focuses both on the interdisciplinary and multidisciplinary aspects of visual computing. Visual computing is an emerging field born from the cross-pollination of computational geometry, computer graphics and computer vision that we have attested in the last twenty years. I design efficient algorithms and data structures for combinatorial problems influenced by geometry, graphics and vision such as image/video/mesh segmentation, videorealistic graphics, or geometric/information-theoretic clustering methods.

I also investigate computational videography, a brand new application area for visual computing. Traditionaly, the visual effects (VFX) pipeline has been considered. That is, sensory input images are first processed into geometric data that are then matched and 3D reconstructed into shapes using geometric modeling.Finally, these 3D scenes are projected back to images from novel viewpoints and composited with photorealistic CG imageries. Computational photography is creating a novel pipeline with the convergence between visual computing and photography by allowing unprecedented rich user experiences to capture, process, search and share digital pictures and videos.

In addition to these topics, I consider computational machine learning and pattern recognition problems from a probabilistic perspective. Many recent high-dimensional algorithms and geometric approximation algorithms are based on the Euclidean metric. In machine learning, vector data do not reside in such spaces and the Euclidean distance between two such samples is meaningless. A much better information-theoretic measure, called a divergence, is far more natural to use. I investigate ways to extend classical geometric structures such as Voronoi diagrams or smallest enclosing balls to these information spaces.

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- "Surround Video: A Multi-Head Camera Approach", Frank Nielsen, The Visual Computer, Vol 21, Number 1-2, pp 92-103, 2005.
- "Semi-supervised Statistical Region Refinement for Color Image Segmentation", Richard Nock and Frank Nielsen, Vol 38, Number 6, pp 835-846, 2005.

張 琪 Qi Zhang

複雑かつ高度なシステムである脳は、21世紀の自然科学に残された最大の未知領域の一つであり、脳を知ることは人間を理解することにつながります。脳機能の中で、視知覚が最も重要な一つであり、特に三次元的な対象物の知覚は、人間が外部世界の認識や理解には不可欠です。私は人間の三次元視知覚の脳内メカニズムについて研究しています。機能的磁気共鳴画像法（fMRI）などを利用し、脳内の活動状態を非侵襲計測することによって、人間の視覚システムのメカニズムを解明したいと思います。視覚野の他に、高次レベルの脳皮質の関与も取り込んで、システム的に脳全体の処理過程を研究しています。人間の脳内視覚処理システムを理解することにより、脳の原理を生かしたコンピュータやロボットの開発に貢献することを目指します。

The human brain is the most complex, sophisticated, and powerful information-processing device known till now. Brain science is said to be the largest frontier and the most important subject for science and technology in the 21st century. One of the greatest mysteries in brain science is the human ability to perceive visually presented objects with high accuracy and speed. Understanding the human brain's 3-D visual mechanism will lead to a breakthrough in brain science. I hope to elucidate the mechanism of human 3-D visual system by measuring brain activity using noninvasive brain imaging techniques such as fMRI, and systematically study human visual processes by connecting with other high-level human brain functions processed in the prefrontal and parietal cortex.

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白石 哲也 Tetsuya Shiraishi

日本人の死因第一位である癌の征圧に向けて多くの努力がなされていますが、一部の癌を除いて期待される結果が得られていません。それは従来の網羅的解析による癌の理解と単一分子を標的とする治療法の限界を意味しています。私は癌をゲノム異常により頑健性を獲得した新しい生物種の誕生という観点から捉え、癌のシステム構造の特徴を解析しています。そしてその構造が持つ頑健性と引き換えに生じた脆弱性に注目し、その脆弱なシステム特性を標的とした治療法を提唱することを最終目標として研究を続けています。二十数年間の脳神経外科臨床医としての経験を生かし、臨床に直結した癌研究のパラダイムシフトを起こしてゆきます。

Although considerable efforts have been made to develop a cure for cancer, the most common cause of death in Japan, we have not yet been able to achieve the desired results, except for certain types of cancers. This implies that conventional molecular biological research and therapeutic approaches that target only a single molecule are inadequate. Cancer is considered to be a system that constantly evolves and becomes more robust. My research goal is to analyze the characteristics of newly established systems, evaluate the architecture of fragile systems and advocate new strategies for treating cancer. Based on the knowledge and experience I have gained during 20 years as a neurosurgeon, I believe that a paradigm shift in cancer research can be achieved via breakthroughs in systems biology.

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- Shiraishi, T, Tabuchi, K (2003) Genetic alterations of human brain tumors on molecular prognostic factors. Neuropathology 23: 95-108.

Fundamental Research Laboratory

Researchers 研究者

大和田 茂 Shigeru Owada

近年ゲームや映画などで用いられているCG映像の素晴らしさには目をみはるものがあり、多くの人々の睡眠時間を奪っています。しかし、物体表現として主に用いられている境界表現方式では物体内部の情報がないため、今後のさらなる技術革新に対応できないと考えられます。そこで私は、現実の物体をより自然に扱えるデータ構造やアルゴリズム、ユーザーインターフェースの研究を中心に行い、これらの有効性を示していきたいと考えています。

Recent advances in CG technology have resulted in highly realistic synthesized images that are almost indistinguishable from real-world sceneries. However, most applications adopt surface representation, which lacks internal information on objects. This representation has an intrinsic inability to accommodate future advances of technologies. My goal is to pursue new data structures, algorithms, and user interfaces that are capable to represent real-world objects more naturally.

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- Shigeru Owada, Frank Nielsen, Makoto Okabe, and Takeo Igarashi, "Volumetric Illustration: Designing 3D Models with Internal Textures", ACM Transactions on Graphics (Proc. Siggraph 2004), pp.322-328, 2004.

田谷 文彦 Fumihiko Taya

生物の神経系の最も重要な役割のひとつは、入力された感覚情報と蓄積されている記憶情報を統合した上で、直面している問題に対して適切な判断を下し、最終的に自らの遺伝情報を伝えることにあります。このような意志決定の過程は、神経経済学と呼ばれる新しい分野で精力的に研究が行われています。特に、人は不確定な状況下でも柔軟に行動することができ、その意志決定には、情動系と認知系の相互作用が重要であると考えられています。異なるモダリティからの感覚情報を統合する過程、記憶情報を想起する過程、言語処理など、幅広い脳科学、認知科学の問題が関わってると考えられています。心理物理実験や機能的磁気共鳴法(fMRI)やMEGによる脳活動のイメージングを通して、意志決定の過程を支える神経機構をシステムレベルで解明することを目指しています。

One of the most important roles of the nervous system of animals is to make appropriate decisions when facing problems by integrating incoming sensory information and stored memory, which ultimately contributes to the propagation of their genetic information. These decision-making processes are just beginning to be studied in neuroeconomics. In particular, it is known that human beings can behave flexibly even in uncertain conditions. Interaction between the emotional and cognitive system has been thought to be crucial in the human decision-making process. Studies on a variety of topics in brain and cognitive science, e.g. the processes of integrating sensory information from different modalities, retrieving stored representations, and language processing, are required. We are studying the neural mechanism underlying the decision-making process at a system level by means of psychophysics or the imaging of brain activities by fMRI and MEG.

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- Fumihiko Taya, Ken Mogi (2005) Spatio-temporal dynamics of the visual system revealed in binocular rivalry, Neuroscience Letters, in press.
- Fumihiko Taya, Ken Mogi (2004) The variant and invariant in perception, Forma, 19, pp. 25-37.

稲岡 創 Hajime Inaoka

複雑系には、個々の効果の組み合わせでは説明が付かない系全体としての効果が見られます。このため、物事を要素に分解して理解する、というアプローチのみでは複雑系の本質を見通してしまいます。その一方、複雑系の振舞をそのまま眺めているだけでは、その本質の理解に迫ることはできません。複雑系の理解のためには、系の振舞を損なわない最低限の相互作用を取り入れた「ミニマルモデル」が必要なのです。私は、物理学、地学、経済学など、様々な分野でのミニマルモデルに共通して見られる数理的な特徴に関心を持っています。最近は、複雑系の研究手法を用いて、消費者の購買パターンの分析など、経済物理の問題に取り組んでいます。

We generally observe phenomena caused by the system as a whole in a complex system. This implies we cannot understand a complex system solely through analyzing individual factors in the system. On the other hand, we cannot unravel the mechanisms of a complex system by recording only its whole behavior. To understand a complex system, we must compose a "minimal model" of the system based on the essential interactions of individual factors. I am interested in mathematical features shared by various minimal models of problems in physics, earth sciences, and economics. I have recently studied problems of econophysics, such as purchasing trends, applying the method to study complex systems.

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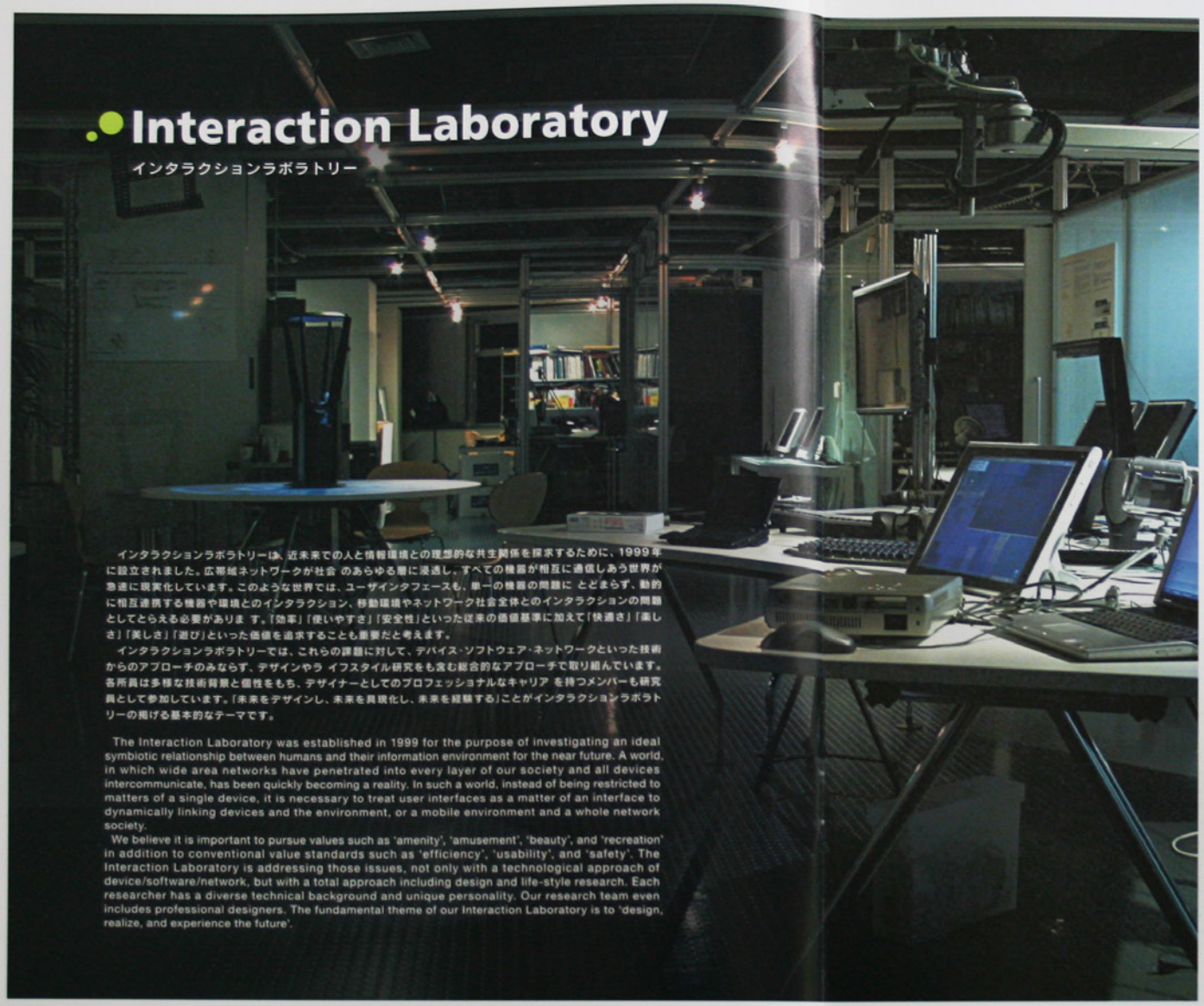
Interaction Laboratory

インタラクションラボラトリー



インタラクションラボラトリーは、近未来での人と情報環境との理想的な共生関係を探求するために、1999年に設立されました。広帯域ネットワークが社会 のあらゆる層に浸透し、すべての機器が相互に通信しあう世界が急速に現実化しています。このような世界では、ユーザインタフェースも、単一の機器の問題に とどまらず、動的に相互連携する機器や環境とのインタラクション、移動環境やネットワーク社会全体とのインタラクションの問題としてとらえる必要があります。「効率」「使いやすさ」「安全性」といった従来の価値基準に加えて「快適さ」「楽しさ」「美しさ」「遊び」といった価値を追求することも重要だと考えます。

インタラクションラボラトリーでは、これらの課題に対して、デバイス・ソフトウェア・ネットワークといった技術からのアプローチのみならず、デザインやラ イフスタイル研究をも含む総合的なアプローチで取り組んでいます。各所員は多様な技術背景と個性をもち、デザイナーとしてのプロフェッショナルなキャリア を持つメンバーも研究員として参加しています。「未来をデザインし、未来を具現化し、未来を経験する」ことがインタラクションラボラトリーの掲げる基本的なテーマです。

The Interaction Laboratory was established in 1999 for the purpose of investigating an ideal symbiotic relationship between humans and their information environment for the near future. A world, in which wide area networks have penetrated into every layer of our society and all devices intercommunicate, has been quickly becoming a reality. In such a world, instead of being restricted to matters of a single device, it is necessary to treat user interfaces as a matter of an interface to dynamically linking devices and the environment, or a mobile environment and a whole network society.

We believe it is important to pursue values such as 'amenity', 'amusement', 'beauty', and 'recreation' in addition to conventional value standards such as 'efficiency', 'usability', and 'safety'. The Interaction Laboratory is addressing those issues, not only with a technological approach of device/software/network, but with a total approach including design and life-style research. Each researcher has a diverse technical background and unique personality. Our research team even includes professional designers. The fundamental theme of our Interaction Laboratory is to 'design, realize, and experience the future'.

暦本 純一 Jun Rekimoto

室長 Director

現在のコンピュータは、情報を操作するための道具として主に使われており、私たちの現実世界での生活を快適にするようには設計されていません。私の研究の興味は、非常に小型でかつ個人化されたコンピュータや、逆に生活環境と一体化したコンピュータ群によって、将来の生活や社会がどのように再デザインされていくか、という点にあります。このようなコンピュータは計算指向であると同時に実世界指向であり、状況認識などの技術によって、従来のように煩雑な指令を与えなくても我々の実世界での作業を支援します。近い将来、このようなコンピュータ群は今日の眼鏡や腕時計のようにあたりまえのものになり、また生活環境の一部として不可欠な存在となるでしょう。

Today's computers serve mainly as tools for manipulating digital information, but are not designed to make our physical world more comfortable. I am interested in designing a new style of human-computer interaction based on highly personalized portable computers and environmentally embedded computers. These computers will be aware of our physical environment and thus will be real-world oriented as well as computation-oriented. This type of environment will enable us to concentrate on real-world tasks with constant augmentation of information by computers. I expect that such computers will be as commonplace as today's eyeglasses and wristwatches, and will be seamlessly integrated into our daily lives.

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Interaction Laboratory

Researchers & Designers 研究者とデザイナー

河野 通宗 Michimune Kohno

ネットワークの使いやすさと安全性はどうすれば両立させられるでしょうか。環境に遍在する多数のコンピュータから個人のプライベートデータにアクセスしたり、各種のセンサが環境データを自動的に収集する世界はすぐそこまで近付いています。しかしそこには、セキュリティとプライバシーという避けて通れない大問題があります。しかも身の回りの道具のように誰でも簡単に利用できなければ結局役に立ちません。私は実世界指向ユーザインタフェースの研究がこの問題の解決に有効であると考えています。ネットワークの複雑な処理をできるだけユーザに意識させずに安全に使えるものにするため、ユーザインタフェース、ネットワーク、セキュリティの各技術の融合を目指しています。

I am currently interested in how to strike a balance between the usability and security of networks. The ability to retrieve our private data from various embedded computers, and responsive environments that automatically gather information from their surroundings will become a reality in the near future. However, security and privacy issues have yet to be solved. Unless networks are as usable as other tools around us, they will not be practicable. I think that real-world user interfaces can definitely contribute to solving this problem. My goal is to combine user-interface techniques with network and security technologies, so that we can use networks without being aware of the underlying complex operations.

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- M.Kohno, Y.Ayatsuka, J.Rekimoto. "TACT: Mobile Terminal for Session Manipulation". The 1st International Conference on Mobile Computing and Ubiquitous Networking, pp.26-31, Jan. 2004.

イワン プピレフ Ivan Poupyrev

コンピュータは便利ですが、単調です。それ故普遍的なユーザビリティや生産性を求めるにあたって、さまざまなアプリケーションとプラットフォームにおいてインタラクションの一様性を図ってきたのです。しかしながら人間は一様性よりも多様性を好むものです。新たな技術によってのみ実現可能な新しいさまざまな経験、私の研究では私達の次のライフスタイルへつながるそんな扉を探しています。現在、私は形を変えることのできるメカニカルデバイスや触覚で情報を伝えることのできるインターフェースといった物理的な感覚をデジタルデータに取り入れるインターフェースの設計、研究をしています。また、仮想現実感(Virtual Reality)や拡張現実感(Augmented Reality)のための3Dユーザインターフェースと同様に小さな携帯端末の新しいインターフェースに関する研究も行っています。より大きな視点では、インタラクションテクノロジーとデザインが人々と社会に与える影響をより深く研究していきたいと思っています。

Computers are convenient because they are dull. In pursuit of universal usability and productivity we adopted uniformity of interaction across a variety of applications and platforms. However, humans prefer variety to uniformity. That is why, in my work, I am looking for opportunities to enhance our lifestyles by creating new and varied experiences possible only with emerging technologies. Currently, I design and research interfaces that add a physical feel to digital data, such as mechanical devices that can change their shape and interfaces that can communicate information through touch. I have also been working on novel interfaces for small handheld computing devices, as well as 3D user interfaces for virtual and augmented reality. On a larger scale, I am interested in gaining a deeper understanding of the impact that interaction technology and design makes on people and society.

- Poupyrev, I. and S. Maruyama. Tactile interfaces for small touch screens. Proceedings of UIST. 2003: ACM. pp. 217-220.
- Bowman, D., E. Kruijff, J. LaViola, and I. Poupyrev, 3D user interfaces: Theory and practice. 2004: Addison-Wesley. pp. 512.

綾塚 祐二 Yuji Ayatsuka

計算機上の世界は、現実の世界の物理的制約にほとんど束縛されません。しかし、人間にとっては、慣れ親しんださまざまな現実の事象に近いもののほうが、理解や操作が(たいていの場合)容易になります。現実の世界の特性とそこから自由なものとを、どう融合させると人間と計算機とのインタフェースとしてより心地好く便利なものができるのかということに興味を持っています。現在は実世界指向ユーザインタフェースと呼ばれる手法を用いた機器と機器との繋がりの制御や、人と人との繋がり即ちコミュニケーションの拡張などの研究を行っています。このようなユーザインタフェースの研究から、人間の認識や知覚の特性の一端を見出だすことができるのではないかとも考えています。

The world within computers is largely free of the physical constraints of the real-world. However, it enables people to recognize and manipulate things and events similar to those in the real world. I am interested in merging these two worlds to create convenient and comfortable human-computer interfaces. My current research topics include controlling the connections between devices and enhancing communication between people using real-world user interfaces. I expect that investigating more efficient user interface will reveal insights into human perception and recognition.

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- Yuji Ayatsuka, Michimune Kohno, Jun Rekimoto, "Real-World Oriented Access Control Method with a Displayed Password", Computer Human Interaction (APCHI 2004), LNCS 3101, Springer, pp.19-29, Jun. 2004.

飛田 博章 Hiroaki Tobita

飛躍的な計算機の発達にともない、3次元CGは映画やゲームを通じて身近なものとなりましたが、多くのユーザにとって、3次元空間に対し意図した操作を行うことは難しいままです。私の研究の興味は、簡単に楽しく自分のアイデアを反映させることができる、3次元空間をデザインする点にあります。そのために、リアリティーを追求するのではなく、空間的な広がりを効果的に使うことや、直感的な(怪しい)インタラクション手法を実現することに興味を持っています。また、こうした手法は、3次元空間内でのクリエーションによるコミュニケーションの実現や、実世界指向インタフェースや情報視覚化への応用も可能であり、コンピュータを介した情報空間とのインタラクションを効果的に支援できるものと考えています。

As computers have evolved, 3D computer graphics have become popular in many fields, such as in movies and games. However, interaction with 3D CG is still quite difficult. I am interested in designing systems which allow users to freely express their own ideas in spaces created by 3D CG. I am focusing on 3D sensitive, pleasant and sometimes even strange forms of interaction rather than reality based interaction. In addition, I think this type of interaction will enhance communication through the creation of a shared virtual world and in combination with Augmented Reality and Information Visualization systems.

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ブライアン クラークソン Brian Clarkson

Most people when they hear a scientist talking about sensors think of security cameras, supermarket scanners, thermometers, and airbag deployment. The typical person is only thinking of sensors that sense the present, the immediate, the stuff that is happening right now. I call them Now Sensors. However, I am interested in Past Sensors that let us sense the past. Future Sensors that let us sense the future by showing us what could happen. Anomaly Sensors that sense the unusual. DejaVu Sensors, that sense when they have sensed something before, and many others. For me sensing is not about automation but rather about opening up new worlds of perception. We are living in Flatland and I want to live to see a future where we are all plucked out of the plane.

Recently, through my collaborations with others, these devices find useful and sometimes surprising ways of acting or allowing us to act on the information provided by their electronic senses. For example, I have worked on video cameras that vaguely remember all of the video that passed through its digital innards and use these vague memories to categorize any video currently stored in the camera. I have worked on an interactive music system that lets you rearrange your favorite piece of music like you would rearrange the faces of Rubik's cube. I have worked on cellphones that let your friends and family know what you are doing simply by analyzing your past and present motions. They are all prototypes of course and far from perfect, but nevertheless indicative of what I believe will be an exciting future.

塩野崎 敦 Atsushi Shionozaki

インターネットはいまや私達の日常生活にとって必要不可欠な存在です。今後は、ネットワーク上で無限に増加するコンテンツに自由にアクセスするためのリッチメディアサービス、洗練されたライフスタイルのためのネットワーク技術のシームレスな融合、今まで存在しなかった新しいサービスの実現などが期待されています。私の研究課題は、既存のインターネットとそのプロトコルの振る舞いと性能を解析し、無線技術やセンサネットワーキング技術を発展させ、新しい形の人間とコンピュータのインタラクションを創造していくことです。現在では、モバイルアドホック環境を前提とした新しいソーシャルネットワーキングモデルの実現、エネルギー効率を考慮したネットワーク、およびスケーラブルなコンテンツ配信のためのオーバレイネットワーク技術に関する研究を行っています。

The Internet has become a social necessity or even an addiction for some users. As the needs and expectations of these users become even more demanding, we are faced with new challenges to provide rich media services with access to an endless pool of content, seamless integration of technology for more convenient lifestyles, and completely new services. By analyzing the behavior and performance of the current Internet and its protocols, and also by extending the state of the art in wireless technology and sensor networking, we are striving to create new modalities of human-computer interaction, new mechanisms necessary to enhance social networking including mobile ad hoc scenarios, energy-efficient networking architecture, and overlay networking for scalable content delivery.

- Real-Time Streaming of Prestored Multiple Description Video with Restart, E. Setton, A. Shionozaki, B. Girod, ICME2004.
- Integrating Resource Reservation with Rate-Based Transport Protocols in AMInet, A.Shionozaki, K. Yamashita, S. Utsumi, K. Cho, WWCA, 1998.

Interaction Laboratory

Researchers & Designers 研究者とデザイナー

西田 佳史 Yoshifumi Nishida

近年ネットワーク技術は、我々の日常の生活に深く浸透し様々な状況で多様な目的で利用されるようになりましたが、同時に安全性や堅牢性や輻輳制御といった問題に対して明確な解決策を早急に提供することも強く求められています。私の研究課題は、多種多様な状況に柔軟に適応できるネットワーク技術と、それを利用者にわかりやすい形で提供できる直観的なインターフェースを実現することです。現在では、IEEE 802.11などに代表される無線通信の応用技術、SCTP、DCCPなどの次世代のトランスポートプロトコルの研究を行っています。

Network technologies are an integral part of our daily lives and are used in various situations for various objectives. At the same time they are also required to provide solutions for security,robustness, quality-of-service, and congestion control. The goal of my research involves developing an autonomous communication architecture that is capable of adapting to various user surroundings. My research also focuses on providing intuitive user interfaces so that users can access the network without following complex procedures. Currently, I am investigating next-generation transport protocols, while developing application technologies that utilize wireless communications, like IEEE802.11.

- 西田 佳史, 村山 公保, 尾家祐二, 岩波講座 インターネット 第3巻 トランスポートプロトコル, 岩波書店
- Y. Nishida, "Enhancing 802.11 DCF MAC for TCP/IP Communication", IEEE Wireless Communication and Networking Conference 2005.

田村 陽介 Yosuke Tamura

近い将来、何千個という「目に見えないコンピュータ」によって我々の生活は支援されるようになります。このような世界に必要不可欠となるのは、拡張性、信頼性、安全性の高いシステム基盤です。特にネットワーク技術の分野では、目覚しいハードウェアの進歩に比べてソフトウェアの進歩は明らかに遅れています。何十年も前に設計された既存のソフトウェア技術にとらわれていては本来のコンピュータの能力を充分に活かす事ができません。コンピュータが身の周りに溢れる世界は、現在のコンピューティング環境とは別物として認識するべきであり、新たな視点から基盤を構築する必要があります。現在、私は無線センサネットワーク基盤や経済指標を利用した新しい通信理論に着目して研究を行っています。

In the near future, our lives will be supported by thousands of invisible computers. Scalable, robust, and secure system architecture will be essential for this computing space. In the network field in particular, progress in developing software technology is clearly slow compared with advances in hardware technology. Current software technology was designed to satisfy past requirements and is incapable of exploiting the potential ability of computers. A world in which enormous computers are introduced around us should be recognized as a world that is different from the traditional world and new fundamental architecture must be built from a new perspective. To build this type of computing space, I am currently engaged in research relating to the architecture of wireless sensor networks and new flow control theory based on economic indexes.

- Y. Tamura, M. Takayasu, and H. Takayas "TCP Optimization for Eliminating Duplicate Segments in Congested Networks", IPSJ, vol. 45(6), June 2004.
- 飯田, 田村, 「ユビキタスセンサーネットワーク技術調査報告書2004」インプレス出版 2004年 10月
- 安藤, 田村, 戸辺, 衛, 「センサネットワーク技術」東京電機大学出版局 2005年5月

田島 茂 Shigeru Tajima

オフィスはもちろん、家庭内にもコンピュータネットワークが装備され、多くのコンピュータが接続されていることが当然の時代となりました。これにより、生活に大きな変化が生じていますが、今のところ、このコンピュータネットワークが、たとえ多少機能停止したとしても生活の危機には直結していません。ちょうど電灯が家庭に普及し始めた時のように、電力が主として照明に使われていた時代と同様です。しかし、コンピュータが生活空間に隠れてしまい、一体何台のコンピュータが自分の生活に関係するのか、どこまでのネットワークが危機に直結するのか、誰もわからなくなる時代がやってきます。このような時代のため、人々の生活とコンピューティング環境を全体で把握することを目指して研究しています。

Computer networks are becoming a common part of the infrastructure of our homes and, in particular, our offices. The many computers connected to these networks have a large impact on our lives. Fortunately, temporary faults in these networks do not yet cause life-threatening problems - like the early days of domestic use of electricity when blackouts presented few dangers. However, we need to be prepared for the time when most computers will be invisible and no-one will know for sure how many computers are operating, or the extent to which various networks are crucial to people's lives. In anticipating that era, I am very interested in how to assess people's activities in networked computer environments.

- N. Matsushita, S. Tajima, Y. Ayatsuka, J. Rekimoto. Wearable Key: Device for Personalizing nearby Environment. Proceedings of ISWC'00, Oct 2000, pp119-126.
- K. Fujii, K. Ito, S Tajima. Signal Propagation of wearable computer using human body as transmission channel. Proc. of ISAP i-02. Nov, 2002, pp512-515.

カーステン シュウェージヒ Carsten Schwesig

現在のほとんどすべての人間とコンピュータとのインタラクションは、机に座ってPCに向き合っていても、あるいは携帯電話を使っていても、ディスプレイを注視して、ボタンを押したり、カーソルを動かしたりといったようなナビゲーション手段でデジタル情報を操作することにより実現されています。インタラクションデザインの研究を通して、私はそれらに代わる新たなインタラクションの方法を見つけようとしています。ひとつ目のアプローチでは、センシング技術とそれに対応したスクリーンインターフェースを使うことにより、実世界の物理的なオブジェクト同様に、デジタル情報を、簡単に、特に意識することなく操作することのできるインターフェースをデザインできないかと考えています。もうひとつのアプローチでは、現在のデバイスをベースにしたインタラクションではなく、何らデバイスを使わずに、テレビに代表されるPUSH型メディアを扱うように、WEBブラウザーに代表されるPULL型のメディアを扱うことのできるインターフェースを模索しています。

Most human-computer interaction takes place in very specific contexts: whether we sit at a desk or hold a mobile phone, we typically focus our attention on a display as we navigate or manipulate digital information by pushing buttons and moving cursors. In my interaction design research, I aim to find new modes of interaction: One approach is to design interaction styles that mirror the subtlety and complexity of the physical world through the use of analog sensing technologies and responsive screen interfaces. Another approach is to move away from hands-on, device-based interaction and to explore the area between /push/ media, such as television, and /pull/ media, such as the web browser.

- Schwesig, C., I. Poupyrev, and E. Mori. Gummi: a bendable computer. Proceedings of CHI'2004. 2004: ACM: pp. 263-270.

戸塚 恵一 Keiichi Totsuka

アナログ時代のデザイナーにとって、モノ作りの一番のパートナーは、エンジニアであり、メカトロニクス技術の進化と供に、デザイナーの欲しいモノが少しずつ現実化された時代でした。現在は、ほとんど全てデジタル/シリコン時代になりつつあり、デザイナーのパートナーはユーザーに変わりました。アプリケーション/使われ方を見出せないと、"カタチ"に出来ないからです。これから、完全なネットワーク時代になって、モノが単体での存在は希薄になり、モノの関係性でのユーザーの経験が価値になっていく時、デザイナーにとっての大切なパートナーは何でしょうか？たぶん、デザイナーの体験そのもの、デザイナー自身のEmotionが発想の大事なパートナーになっていきそうです。

In the analog era, designers' partners in creating products were engineers. Designers' dreams were realized bit by bit along with the evolution of mechatronics technology. Today, we live in a digital/ silicon era and accordingly, designers' partners have changed to our customers' the people who actually utilize our products and services. This is due to the fact that we need to comprehend and create the manner in how products, applications and services are used in order to create the form and the design. In the near future, the network environment will be more complete. The existence of products is going to weaken, as the importance shifts more to the experience of our customers with the connectivity of products. Who will be our next partners in such era? Probably designers' own experience and emotion will be.

中野 広明 Hiroaki Nakano

自分のこの研究所における役割はデザインと技術とを結合させて、ユーザーに新たなデジタル時代のエクスペリエンスを提供することにあります。現在は特に二つの領域、モバイルコミュニケーションと3Dインタフェースについて開発を進めています。ユーザーにエクスペリエンスと呼べる体験を与えるためには、インタラクションデザインの改良、改善だけではなく、トータルでデザインを考える時代に来ていると考えています。そのためにはプロダクト自体のはっきりとしたコンセプト、質の高いサービス、そしてインタラクションが一体となって機能するような新しいデザインフレームワークが必要です。そうしたフレームワークを構築するために、デザインのプロセス自身を改革する必要があります。単に新しいデザインスタイルを開発するだけでなく、技術の進化を積極的に肯定し、それをユーザーのメリットに転換するためのデザインフレームワークを模索しています。

My role in this research laboratory is to combine interface design with communication technology and offer users new ways of experiencing digital technology. In particular, the main focus of my current work is in the fields of mobile communication and 3D interface design. I feel that it's no longer good enough to simply add improvements to existing interaction designs because we've reached the stage where we need to conceive new and innovative designs to broaden a user's experiences. The development of a total design calls for the establishment of a new design framework that can combine clear product concept, high quality content and services, and user-product interaction into a functioning whole. Such a framework can only be built by transforming the actual design process itself. My objective is not limited to developing new design styles; I also actively embrace new technologies and am engaged in formulating a design framework that will apply the new technologies for the benefit of our users.

Sony CSL Paris

CSL Paris was founded in 1996 and is a small but booming research cell, focusing on four areas: personal music experience, computational neuroscience, developmental cognitive robots, and self-organising communication systems.

Research in Personal Music Experience focuses on the future of musical listening by building prototypes of interactive devices and ethnographic experiments to see what people find exciting in music and how new ways of listening integrate in their lives. The Computational Neuroscience group uses mathematical and computational techniques to make realistic models of the brain, in particular the cerebellum. This is expected to yield radically new ideas for building adaptive machines with life-like learning behavior.

The Developmental Cognitive Robotics group tries to work out a scenario in which an autonomous embodied robot in interaction with the environment, other robots, and human beings, can bootstrap cognitive behavior and intelligence.

Research in self-organising communication systems investigates through computational simulations and mathematical models how a group of autonomous agents could be able to invent and negotiate a communication system similar to human natural languages.

CSL Paris plays a leading role in the areas it has chosen to be active in. It produces a steady stream of papers in the most prestigious journals and conferences. The lab is viewed as highly innovative and playing a leading role in European IT research.

Luc Steels

Director

Human beings are unique because they have developed the capability to create and interpret rich representations, like graphical images and language. I am interested to understand where this capability has come from, both in our species and in the developing child. I focus in particular on how categories (like colours) can be grounded in perceptual experience and develop under the strong influence of language, and how grammars and the semantic domains expressed by grammars may emerge in a population of agents. Applications are far reaching, ranging from adaptive communication systems for humanoid robots to evolving ontologies and communication protocols with emergent semantics.

- Steels, L. and T. Belpaeme (2005) Coordinating perceptually grounded categories through language: A case study for colour. Target Article Behavioraland Brain Science, September 2005.
- Steels, L (2005) The Role of Fluid Construction Grammar in Language Grounding. Artificial Intelligence, Vol 164.

Sony CSL Paris

Researchers

Olivier J.-M.D.Coenen

My principal objective is to construct mathematical and computational models of the brain focusing in particular on the sensorimotor interactions of the organism with its external environment. To provide contextual constraints on brain modeling in complete action-perception loops, one major focus of investigation has been on the cerebellum. With its participation in brain function that ranges from regulation of simple motor reflexes to participation in higher cognitive functions, and its systematic architecture, the cerebellum provides an excellent test bed to investigate plasticity, information processing and representation in neural models during complete sensorimotor interactions. Real-time spiking neural network simulations of an adaptive model of the cerebellum with thousands of neurons have been developed. Its learning abilities and processing abilities are currently being validated in real robotic and simulated environments.

I am interested in applications of information theory to neural coding and in extending our comprehension of the cerebellum interactions with the major brain areas involved during active sensing and perception. In a more global perspective, I am also interested in the analysis of the sensorimotor laws that underline our interactions with the environment. This is to gain a better understanding of the constraints that the central nervous system faces when interacting with the outside world. One interest is to apply our knowledge of neural processing and sensorimotor interactions to the elaboration of sensory augmentation and sensory substitution systems as well as sensorimotor illusion devices.

- Philipona, D., O Regan, J.K., Nadal, J.-P. and Coenen,O. J.-M. D. Perception of the structure of the physical world using multimodal unknown sensors and effectors. Advances in Neural Information Processing Systems, 16, 2004.
- M. Bezzi, Nieus, T., Coenen, O. J.-M. D. and D Angelo, E. An integrate-and-fire model of a cerebellar granule cell. Neurocomputing, 58-60:593-598, 2004.

Peter Hanappe

I am interested in new modes of content production, dissemination and retrieval in a highly connected, digital society. I focus on the semantic interoperability in peer-to-peer networks and the authorship management for collaborative production methods.

The assumption underlying the exchange of data between information systems is that all data is organised similarly and that there exists an agreed upon set of keywords to express the search queries. This assumption does not hold in in peer-to-peer systems that lack central control. To achieve semantic interoperability, we extend information systems so that that peers can develop and negotiate their own communication protocols in interaction with the data world and the world of human users. The agents thus autonomously create an Interlingua which they can each interpret locally. Just as in human natural languages, the consensus will be forever emergent, adaptive, and local.

I am also interested in Creative Communities. Creative Communities are open ecosystems that use production method based on voluntary collaboration and sharing, and whose works can be distributed and reused freely. I study possible technological enhancements that may improve the sustainability of these ecosystems, such as transparent authorship management and version control.

- Peter Hanappe, "Building Open Ecosystems for Collaborative Creativity". In "How Open is the Future? Economic, Social & Cultural Scenarios inspired by Free and Open Source Software", Marleen Wynants & Jan Cornelis, Editors. VUB Brussels, University Press, 2005. ISBN 90-5487-378-7.

Frédéric Kaplan

Understanding the dynamical processes underlying children's development in the first years of their life is a challenging scientific issue at the crossroads of neuroscience, learning theories and developmental psychology. Children are capable of acquiring new competencies in a continuous and open-ended manner and as they do so, they develop increasingly complex forms of awareness about their environment. A large amount of work in the developmental psychology literature describes how new skills build one upon another, suggesting a continuum between sensory-motor development and higher cognitive functions. But very few plausible low-level mechanisms exist to explain how such skills emerge or self-organize.

Studying development is intrinsically difficult because of the complex interplay between embodiment, learning mechanisms and environmental dynamics. Doing experiments with robots is however a possible way out. I have designed new biologically-inspired architectures for autonomous robots and conducted experiments in different physical and social contexts in order to study autonomous development from a dynamical system perspective. I believe that such kind of embodied constructivist models offer a relevant framework for bridging the gap between the neural basis of learning and higher-level cognitive development. Currently I am developing a formal theory of developmental systems based on a dynamical system perspective. In the long run, my hope is that this fundamental research program will shed new light on the developmental processes involved in the brain, giving rise at the same time to the technological basis for a radically new kind of autonomously developing devices.

- Kaplan, F. (2005) Simple forms of distributed coordination, Connection Science (in press).
- Kaplan, F. (2005) Les machines apprivoisées (Tamed machines), Vuibert, Paris.
- Kaplan, F. and Oudeyer, P-Y. (2004) Maximizing learning progress: an internal reward system for development, in Iida, F. Pfeifer, R. Steels, L. and Kuniyoshi, Y. (eds) Embodied Artificial Intelligence, LNAI 3139, pp. 259-270, Springer-Verlag, Berlin.

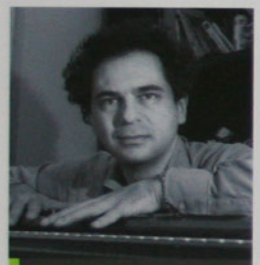
Sony CSL Paris
Researchers

Pierre-Yves Oudeyer

The main focus of my research is how patterns of increasing complexity can form in the interactions between organisms and their environment. A first domain in which I study this question is the emergence of a speech code: the set of sounds and sound patterns used by a group to carry information. I have developed several systems and a theory showing how a generic coupling of perception and action both within and across agents can lead to the self-organization of vocalizations which are digital, combinatorial, and shared by the population. This theory is also able to predict the frequency of the different types of vowel systems which appear in human languages.

My second domain is the study of mechanisms that can drive the open-ended cognitive development of an autonomous robot. I am working on motivational systems that are internal and self-driven as opposed to external and orchestrated by a superviser. One of the first experiments in which I have demonstrated this internal motivational system is a 'Playground Experiment' in which a robot first focuses on situations which are easy to learn, then shifts progressively its attention to situations of increasing difficulty, avoiding situations in which nothing can be learnt.

- Oudeyer, P-Y. (2005) The Self-Organization of Speech Sounds, Journal of Theoretical Biology, Volume 233, Issue 3, pp.435 – 449.
- Oudeyer P-Y., Kaplan F., Hafner, V., Whyte A. (2005) The Playground Experiment: Task-Independent Developmentol a Curious Robot, Proceedings of the AAAI Spring Symposium Workshop on Developmental Robotics. AAAI, Menlo Park, Ca.



François Pachet

I am interested in attention, and more specifically in the ability of temporal phenomena such as music, games, videos, novels, and conversations, to attract and sustain our attention. What is it that makes music "interesting"? That makes some novels page-turners? What makes movie hits? Certain conversations exciting? I address these questions in the domain of entertainment, music in particular, from various viewpoints: Design, i.e. interactive software; experimental psychology, i.e. how to model our attention system. The applications of these models developed range from new Electronic Music Distribution schemes to interactive 3D music listening environments.

The Music Browser application addresses large-scale music browsing using content-based access methods. The Music Browser tries to learn user-specific taxonomies and initiates browsing interactions with the user that help him find interesting, unknown titles.

The Continuator is a system that proposes a novel form of musical interaction with users. By learning continuously the musical "style" of the user, the system initiates musical dialogues that are increasingly consistent and appealing.

- Pachet, F., Addessi, Anna-Rita When Children Reflect on Their Playing Style: The Continuator. http://www.csl.sony.fr/General/Publications/Bibliography/item.php?reference=pachet%3A03f ACM Computers in Entertainment, 1(2), 2004.
- Zils, A. and Pachet, F. Automatic Extraction of Music Descriptors from Acoustic Signals using EDS. http://www.csl.sony.fr/General/Publications/Bibliography/item.php?reference=zils%3A04a Proceedings of the 116th AES Convention, 2004.
- Pachet, Francois Beyond the Cybernetic Jam fantasy: The Continuator. http://www.csl.sony.fr/General/Publications/Bibliography/item.php?reference=pachet%3A03g IEEE Computers Graphics and Applications, January/February 2004. Special issue on Emerging Technologies.
- Pachet, F. "Content Management for Electronic Music Distribution: the Real Issues", Communications of the ACM, March 2003.

Pierre Roy

Today, huge collections of multimedia contents are available over the Internet, on home computers or even on portable devices. Databases of several hundred thousand audio and/or video files have become commonplaces. This context raises many issues regarding data organization, user queries and, more generally, access to those contents. One of the most challenging issue we are facing is to design algorithms and tools for providing users with new efficient ways of accessing their own or other people's contents. These tools have to scale-up to very large collections, and be robust enough to integrate seamlessly in home or portable devices.

Addressing this problem requires to tackle the whole chain from high-level specification down to efficient implementation on dedicated platforms. To handle the inherent combinatorial complexity of these problems, I design novel Operation Research and Artificial Intelligence exploration techniques, borrowing from the fields of intelligent search, pruning strategies, dynamic programming and constraint satisfaction. Not only do the algorithms have to be efficient, but they are also designed to be easily distributed and vectorized to take advantage of the power of networks and of modern hardware features. Finally, I also study the efficient implementation of these techniques with an emphasis on code verification, robustness and scale-up.

- An efficient nearest neighbor algorithm that scales up to very large databases. Roy, P. and Aucouturier, J.J. and Pachet, F. and Beurive, A. Sony CSL, Technical Report, April 2005, CSLP-2005-01-01.

Atau Tanaka

Sound is as pervasive as light in our daily lives. People are affected by sound and moved by music, but are more at ease describing visual situations. The means we have to sculpt our sonic environment are not as developed as the ways we define our visual spaces. I seek to understand the power and mystery of aural media, and create ways to enhance the quality of life through novel sonic interaction. Can sound be the basis of personal identity? Can we merge personal listening and public space? Can urban mobility lend to malleable sonic structures? Can network communities create socially driven music? This work calls upon techniques from the fields of interaction, signal processing, social computing, and cultural theory. The goal is to conceive of future forms of audio contents. Experiments are conducted in public situations, including art projects that serve as controlled environments. In this way, culture becomes a technology driver. The results of this work are applied to define new modes of production, dissemination, and consumption of sound media and music. The long range potential lies in exploiting this vision to redefine music itself.

- Tanaka, A. "Mobile Music Making". In Proceedings of International Conference on New Interfaces for Musical Expression (NIME04),Hamamatsu, pp. 154-156, 2004.
- Tanaka, A. "Interaction, Agency, Experience, and the Future of Music". In Brown, O'Hara (eds.) "Re-Inventing Music", Kluwer Press, 2005.

Message from Founder

土井 利忠　Toshi T. Doi

ソニーコンピュータサイエンス研究所 取締役 ファウンダー
ソニー株式会社 特別理事

Founder, Sony Computer Science Laboratories, Inc.
Senior Research Fellow, Sony Corporation.

ソニーコンピュータサイエンス研究所は、1988年2月にソニー株式会社とは別法人として設立されました。内外のトップクラスの研究者に参加していただくために、通常の企業内研究所ではできない環境と待遇を提供するためにわざわざ別法人にしたのです。すでに、多くの研究成果が研究員と共にソニーに移管され、商品に反映されたのと同時に、ソニーが家電メーカーからITやネットワーク技術を中心とするメーカーへ脱皮する原動力になりました。1996年10月には、フランスにCSLパリをオープンし、複雑系、芸術工学、脳科学などのテーマを設定しました。

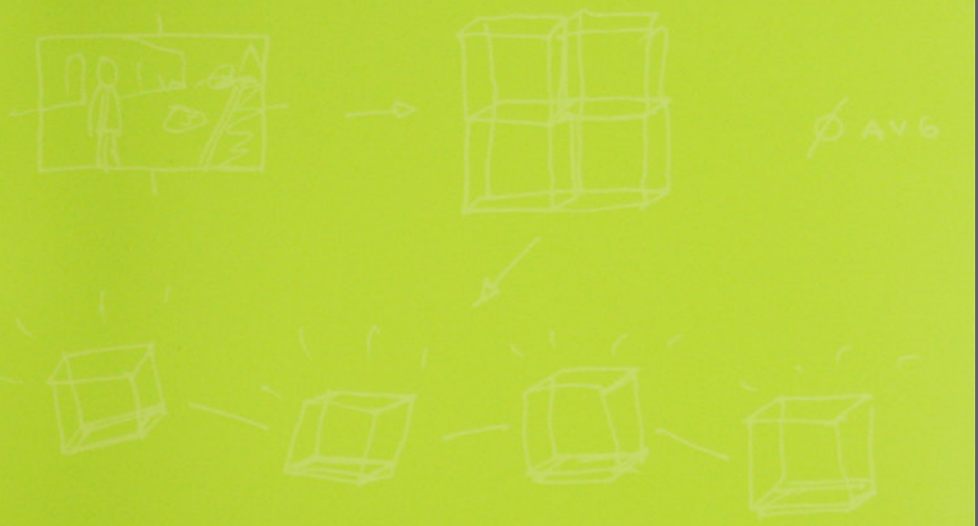
ソニーCSLの使命は、世の中の常識をつくがえすようなブレークスルーを創り出すことです。これまでに、ユーザーインターフェースに関する画期的な研究成果がソニーの商品に活かされ、また、「システム・バイオロジー」、「エコノフィジックス」、「システム脳科学」という3つの全く新しい学問分野が創出できました。

今後も引き続き新たなテーマに挑戦し、ブレークスルーを創出して行きます。皆様の尚一層の御支援をお願いいたします。

The Sony Computer Science Laboratories were established in February 1988 as a separate entity of Sony Corporation. In order to have the participation of first-class researchers from all over the world, we made it a separate body in order to create an environment and offer benefits to our researchers that are not available in conventional in-house laboratories. Many research outcomes have already been shifted to Sony, along with the involved researchers, and applied to Sony products. We have contributed a significant push for Sony to move away from being an audio-visual appliance manufacturer to playing a role in the field of IT and Network Technology. In October 1996, our CSL Paris was established in France, pursuing themes such as complex systems, art and neuroscience.

The mission of Sony CSL is to create breakthroughs that change our daily life. Many research results of the User Interface have been exploited in Sony's products. Also, three new fundamental research areas, 'Systems Biology' 'Econophysics', and 'System Brain Science' have been created. We will continue to pursue new themes and engineer technological breakthroughs.

We would like to ask for your continued support.



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