PIONEERS AND PATHBREAKERS

Hiroshi Kawano (1925–2012)

Japan's Pioneer of Computer Arts

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ABSTRACT

Hiroshi Kawano was one of the earliest pioneers of the use of computers in the arts in Japan, and indeed the world, publishing his first ideas about aesthetics and computing in 1962 and computer-generated images in 1964. This paper provides an introductory overview to Kawano's work and influences from his earliest studies in aesthetics and his interest in the work of Max Bense in the 1950s, to his change of approach in the 1970s through his developing interest in artificial intelligence, until his final exhibition, a retrospective of his work held at the ZKM | Zentrum für Kunst und Medientechnologie in 2011. This paper utilizes previously unused sources including interviews conducted by the author with Kawano in 2009 and subsequent correspondence, as well as Kawano's rich archive that was donated to ZKM in 2010.

Hiroshi Kawano (1925–2012) (Fig. 1) was one of Japan's foremost pioneers in computer arts. He was the first in Japan to begin investigations into the possibilities of using computing technology in the arts in the early 1960s, and took a unique position as a philosopher and aesthetician who approached computing technologies with a view to experimenting with aesthetic theory, rather than as an artist or engineer. His work in this area spanned five decades, covering visual arts, music, poetry, theory and philosophy relating to computing. His rich archive (donated to the ZKM | Zentrum für Kunst und Medientechnologie, Karlsruhe, Germany, in 2010) (Fig. 2) represents the development of his ideas from the earliest experiments to his latest explorations and shows his engagement with international discussions and debates.

Kawano first studied traditional approaches to aesthetics in the Department of Philosophy at the University of Tokyo as both an undergraduate (1948–1951) and a graduate student (1951–1955). Despite his love of traditional aesthetics, Kawano moved away from this approach as an assistant in the Department of Aesthetics at the University of Tokyo between 1955–1961. It was during this time that Kawano came across

Fig. 1. Hiroshi Kawano (at left) with designs for *Simulated Colour Mosaic*. (Photo © Simone Gristwood.)
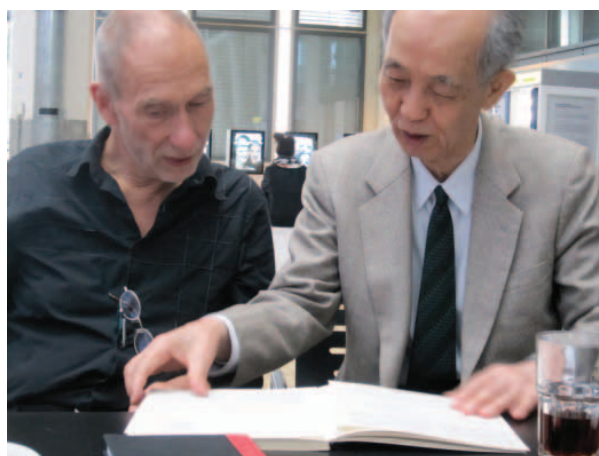

Fig. 2. Frieder Nake and Hiroshi Kawano at ZKM in 2010. (Photo © Simone Gristwood.)

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the work of German philosopher Max Bense and American mathematician Claude Shannon. Kawano hoped to find a breakthrough in his approach to the study of aesthetics—and after reading Bense's *Aesthetica* Series [1] and Shannon's papers about Information Theory and Communication [2], he began to see the potential uses of these theories and the possibility of their application to visual expression using Markov chains.

In 1962, the University of Tokyo opened a computer center that any member of the University staff or student body could use to study programming. Kawano first began to study programming at this center in 1963. He learned assembler language on an OKITAC 5090A electronic computer (Kawano first used Fortran in 1966).

Kawano first published an article about his ideas on "information aesthetics" in 1962, a year before he started to learn programming, titled 美学的情報理論の一考察 ("Inquiry into Aesthetic Information Theory") [3]—a work undoubtedly influenced by his reading of Bense. Following this, some of his designs were published in the *Japan IBM Review* [4] and the *Kagaku Yomiuri* [5]; see Figs 3 and 4), making Kawano one of the earliest pioneers of using computers in the arts to have his works published. He programmed these designs in 1963 and executed them using the OKITAC 5090A in 1964, after learning assembler language. The designs were based

Fig. 3. *Kagaku Yomiuri* (November 1964), cover image by Hiroshi Kawano. (Source: Hiroshi Kawano Archive at ZKM | Center for Art and Media Karlsruhe. © The Yomiuri Shimbun, Tokyo.)

on Markov chains and were printed using line printers—the only printers that were available in the computer center at this time. Another piece known as *Series of Pattern: Flow* was published in 1965. *Series of Pattern: Flow* was "a prototype for his masterpiece *Simulated Colour Mosaic* (Color Plate D and Fig. 5) using quadruple Markov chain for the vertical and horizontal directions, which was published later in 1969" [6]. The output prints for Kawano's work contained color data (for an example, see Fig. 6), and Kawano would sometimes enlist his students to help color.

These publications were influential to other pioneers in Japan, such as the Computer Technique Group (CTG), who were active as a group between 1966–1969 and exhibited internationally. The images were seen by Masao Kohmura, then a fourth-year university student at Tama Art University, who went on to become a cofounder of the CTG in December 1966. This connection was solidified in 1968 when Kawano met the CTG and Kohmura, with whom he remained in contact from then on; they had great respect for each other's work. Kawano had previously met one of the founding members of the CTG, Haruki Tsuchiya, earlier in March 1966 at a meeting of Computer Based Art (C.B.A.) organized by Shigeru Watanabe of Tokyo University [7].

In 1967, Kawano published his first book, 美学 [*Aesthetics*] [8], and Japan held its first computer art contest at the Sankei Building in Tokyo. The exhibition of contest entries was held in March 1968 and included works by Kawano and the CTG as well as the first computer animation in Japan by SARASVATI (Gaku Yamada, Yoshio Tsukio and others) and entries from overseas (primarily the U.S.A.). A summary of the exhibition appeared in *COMPUTOPIA* magazine in April 1968 [9]. The exhibition was organized by a publisher rather than an art gallery or institution. In an interview with the author in 2009, Kawano commented that he thought that this was a high-quality exhibition for its time and pointed out that it predated the influential Cybernetic Serendipity exhibition at the ICA in London that was held later that year (August–October 1968). Another significant event for Kawano in 1967 was a meeting with Max Bense, who was visiting Japan at that time to give a series of lectures. Kawano met Bense in Tokyo at Waseda University [10].

Kawano held his first solo exhibition at the Plaza DIC (Dainippon Ink and Chemicals Inc.), Tokyo, 5–14 October 1970. The Plaza DIC is the exhibition hall of the Great Japan Ink Company, a printing company situated in the Nihonbashi area of Tokyo. The exhibition space was found with the help of Kawano's friend Mitsuo Katsui, a well-known graphic designer of the time. The preparation for the exhibition took approximately six months to complete, including the programming and printing and the painting of the output. The works were completed on a HITAC 5020 mainframe computer designed by Hitachi, using FORTRAN IV code. In an article about the exhibition published in *Graphic Design*, Kawano is credited for "planning, programming and text," and the HITAC5020 computer for "design and works" [11]. This attribution of the computer to a particular aspect of the creation of his art is a clear demonstration of how Kawano's
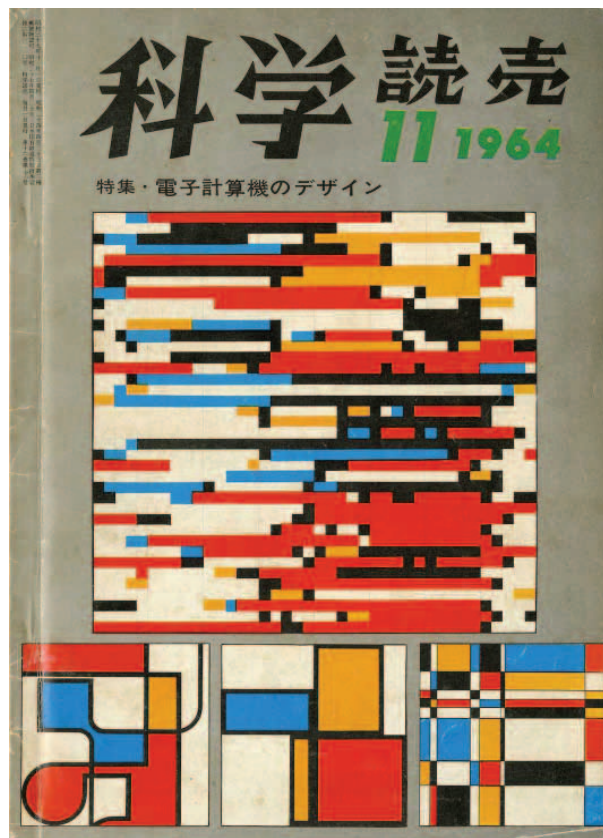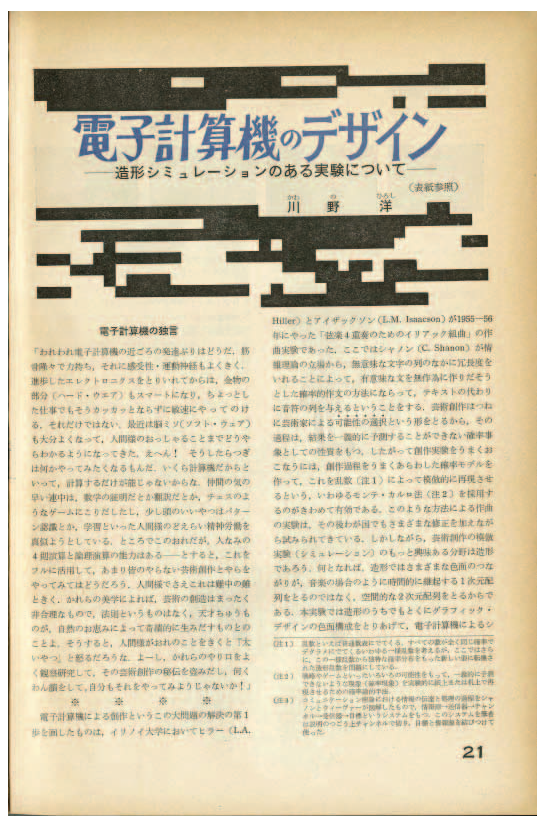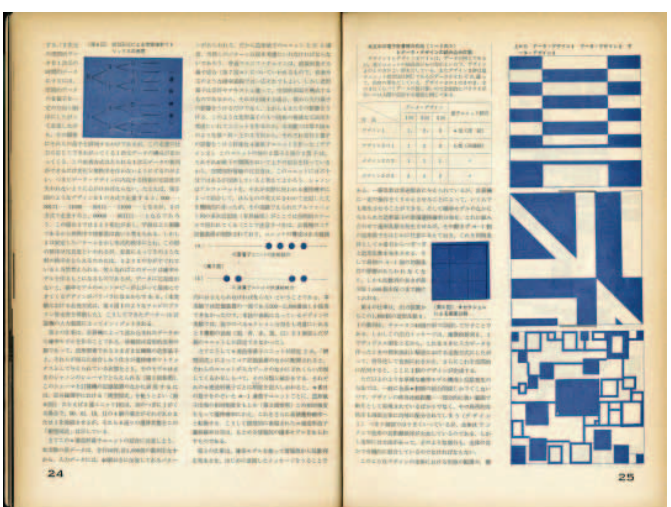
Fig. 4. *Kagaku Yomiuri* (November 1964) article by Hiroshi Kawano. (Source: Hiroshi Kawano Archive at ZKM | Center for Art and Media Karlsruhe. © The Yomiuri Shimbun, Tokyo.)
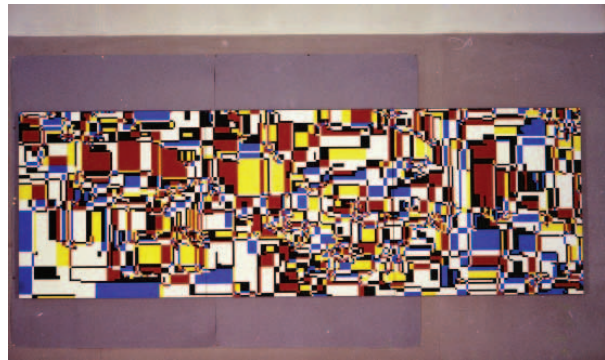

Fig. 5. Hand-colored printout page for *Simulated Colour Mosaic*, 26 September 1974. This version was done on an IBM System 360 at the IBM Data Center. (Source: ZKM | Archives, © ZKM).
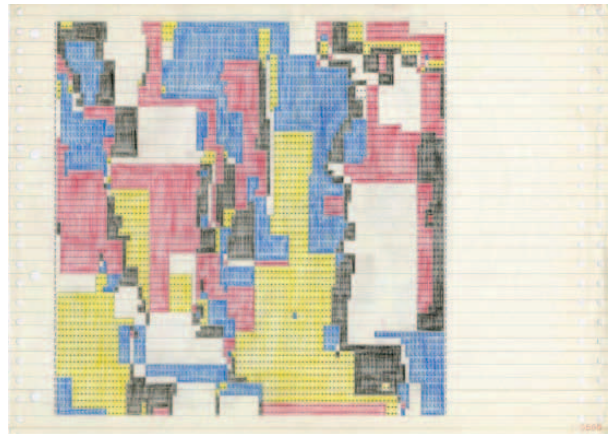

Fig. 6. Part of *Simulated Colour Mosaic* (1969). (Source: ZKM | Archives. © ZKM.)

thoughts were developing about the relationship between humans and computers in the creative process.

The solo exhibition showcased Kawano's work, including *Simulated Colour Mosaic* (1969) (Fig. 7), as well as other studies and output (Fig. 8). It also showed his early ideas beginning to evolve in relation to artificial intelligence and art, such as the example above, in which Kawano attributes design and works to the computer, a topic he would come to explore more deeply from the mid-1970s onward.

Beyond 1970, Kawano continued to participate in a number of international exhibitions and events and was in regular contact with those working with computers and the arts internationally. He also moved away from the Markov model and began investigating artificial intelligence (AI). In 1971, he demonstrated his interest in AI further at the International Colloquy of Computer Art in Zagreb, where he presented a paper titled "Computer Art as Artificial Intelligence" [12]. His works also caught the attention of many now internationally renowned pioneers, and the letters Kawano wrote represent a dialogue of ideas between important artists and institutions. For example, there is evidence of correspondence with pioneers such as Waldemar Cordeiro (1925–1973), A. Michael Noll (1939–), Frieder Nake (1938–), Herbert W. Franke (1927–) and members of the Computer Arts Society (CAS U.K.) amongst many others, spanning the thirty years 1968–1998. He also corresponded with people such as Alan C. Shaw, who developed PDL (Picture Description Language) as part of his PhD applying this linguistic model to analyze pictures [13], which influenced Kawano's AI work, which used a similar model to generate pictures, as well as Harold Cohen, another pioneer of using computers in the arts, known most for his AI-inspired art program AARON. One letter that stands out is from the United States Department of the Army in July 1970. The organization had established a display in the Army Operations Center in the Pentagon and the letter stated that "we have seen your computer art, titled Pattern of Flow and would like to add it to our display," requesting a copy to be framed and displayed, along with technical information [14]. Kawano replied to the letter in September 1970 stating that he had posted a copy of his work. In his reply he also explains how his computer art was not artistic activity, but rather scientific research regarding art made by computers—a description that concisely defines his approach. This demonstrates not only the variety of people who knew of Kawano but also an international network of pioneers sharing ideas and learning from each other, as well as opening up new avenues for research and history of the area.

Kawano's interest in AI continued to grow in the 1970s. His activities included further papers on the subject, a short essay in Ruth Leavitt's 1976 book *Artist and Computer* [15] about computer art and AI, and a visit to the MIT AI Lab. Leavitt commented in a personal letter to Kawano in 1975 how she thought he was one of the few artists who did not want to use the computer as a tool [16], an idea Kawano was developing through investigating the AI approach, particularly since his change in direction from the Markov model.

In a letter to Canadian artist and curator Gilles Gheer-

Fig. 7. Hiroshi Kawano with designs for *Simulated Colour Mosaic*. (Source: ZKM | Archives. © ZKM.)
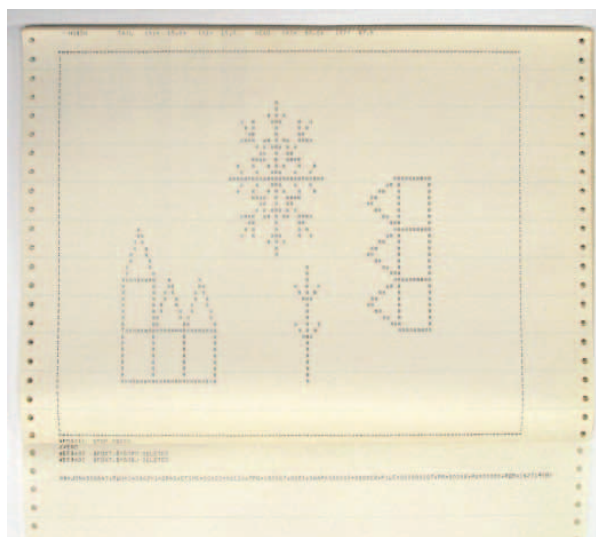

Fig. 8. Hiroshi Kawano, PDL image, 1974. (Kawano was investigating Shaw's picture description language at the time). (Source: ZKM | Archives. © ZKM).

brant, Kawano demonstrated profound awareness of the status of computer arts at this time; he stated: "I think, it will take long time to promote computer art, during which there would be a period of slow progress," noting the problem of reactions to computer art, largely based on methods [17]. He saw AI as a way to a new "progressive period of computer art" that would overcome these difficulties.

To pursue his interest in AI further, in 1978 Kawano

contacted Seymour Papert (1928–2016) at MIT to request permission to visit the school's AI lab. Under Papert's supervision, Kawano spent three months learning LOGO, a programming language originally developed by Papert, to be able to use it in his work.

In the 1980s (exact date unknown), Kawano stopped programming but continued to develop his aesthetic and theoretical ideas. His interests can be traced through his continued correspondence (over 100 letters remain in the archive from the period 1981–1995 alone) with AI researchers, artists and philosophers, prompting dialogue not only between Japan and the world but also between artists and scientists. Kawano described the increasing popularity of microcomputers and 8-bit PCs in the early 1980s and the commercialization of these machines as the reason he stopped programming. He thought that the growth and proliferation of computer software facilitated the use of computers as a tool, which Kawano thought undermined the special qualities that computing could offer. That is, like several other early pioneers of the uses of computers in the arts, Kawano was interested in "mind-work" rather than simply using computers to replace work by hand.

As he continued his theoretical research in the mid-1980s, Kawano became particularly interested in the work of AI expert Marvin Minsky, whose ideas he first encountered at MIT in the 1970s. Minsky's 1986 book *The Society of Mind* [18] had a lasting influence on Kawano's theoretical work. Simply put, in *The Society of Mind*, Minsky posited that the human mind is made up of many decentralized smaller parts—"a society of agents," that are in themselves "mindless" but that work together to accomplish a larger goal—an idea that Kawano thought could successfully be applied to creating art by computer.

Kawano then saw a distributed parallel-processing model (DPP), based on Minsky's work, as the only model for generating real computer art, rather than the software-based approaches where the "program has gradually lost the part of central control parts, and as a result, the computer, which ought to have a responsibility for creative production of the artwork, degenerates into a marionette manipulated by human hand" [19]. Kawano continued to pursue his research in DPP, or what he termed "post AI," and published prolifically on aesthetics and computer art until 2011, with over 70 articles in the 1980s alone [20]. In his penultimate book, *The Birth of Network Aesthetics*, published in Japanese in 2009 [21], he tried to develop his ideas surrounding DPP further.

In recent years, with the resurgence in interest in the early pioneering period of computer arts, Kawano's work has begun to have more exposure. Publications in English are beginning to emerge, such as the long-running bulletin of the *Computer Arts Society* (CAS), special issue [22], where Kawano's work was introduced by Japanese artist Yoshiyuki Abe, and the edited volume by Margit Rosen in 2011 [23] about New Tendencies and Bit International 1961–1973 that includes works by Kawano. These publications begin to demonstrate the significance of Kawano's work in the context of the histories of computer arts.

In addition to publications and discussions of his work and memories, in 2011 ZKM held the first retrospective exhibition of Kawano's works, many of which had never been seen outside of Japan. The exhibition displayed a variety of works and memorabilia, from Kawano's earliest studies of German to his later ideas surrounding AI, as well as some of the works from those with whom he was in contact with for many years.

Despite this resurgence, and that many of his written works were written in English, Kawano's work remains little known. Nevertheless, his explorations in aesthetics since the 1950s, from Max Bense and Claude Shannon to Seymour Papert to MIT and Marvin Minsky, as well as the wealth of materials held in his archive, deserve further scrutiny in the context of both local and international histories of computing in the arts.

References and Notes

This article has been developed primarily through previous discussions and correspondence between the author and Hiroshi Kawano and by utilizing materials from Kawano's archive, now held at ZKM | Zentrum für Kunst und Medientechnologie, Germany.

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2 Kawano commented in an interview that he read first about Information Theory followed by Shannon's earlier work about communication theory. He was not specific about which papers he read.

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SIMONE GRISTWOOD *received her PhD from Lancaster University. Her research focuses on uncovering the histories of the use of computing in the arts and design from the 1960s onward, primarily through investigating the archives of pioneers. She has previously worked with numerous archives in this area, including at ZKM | Zentrum fur Kunst und Medientechnologie, Germany, the Computer Arts Society U.K. and the Royal College of Art, London.*

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COLOR PLATE D: **HIROSHI KAWANO (1925–2012): JAPAN'S PIONEER OF COMPUTER ARTS**
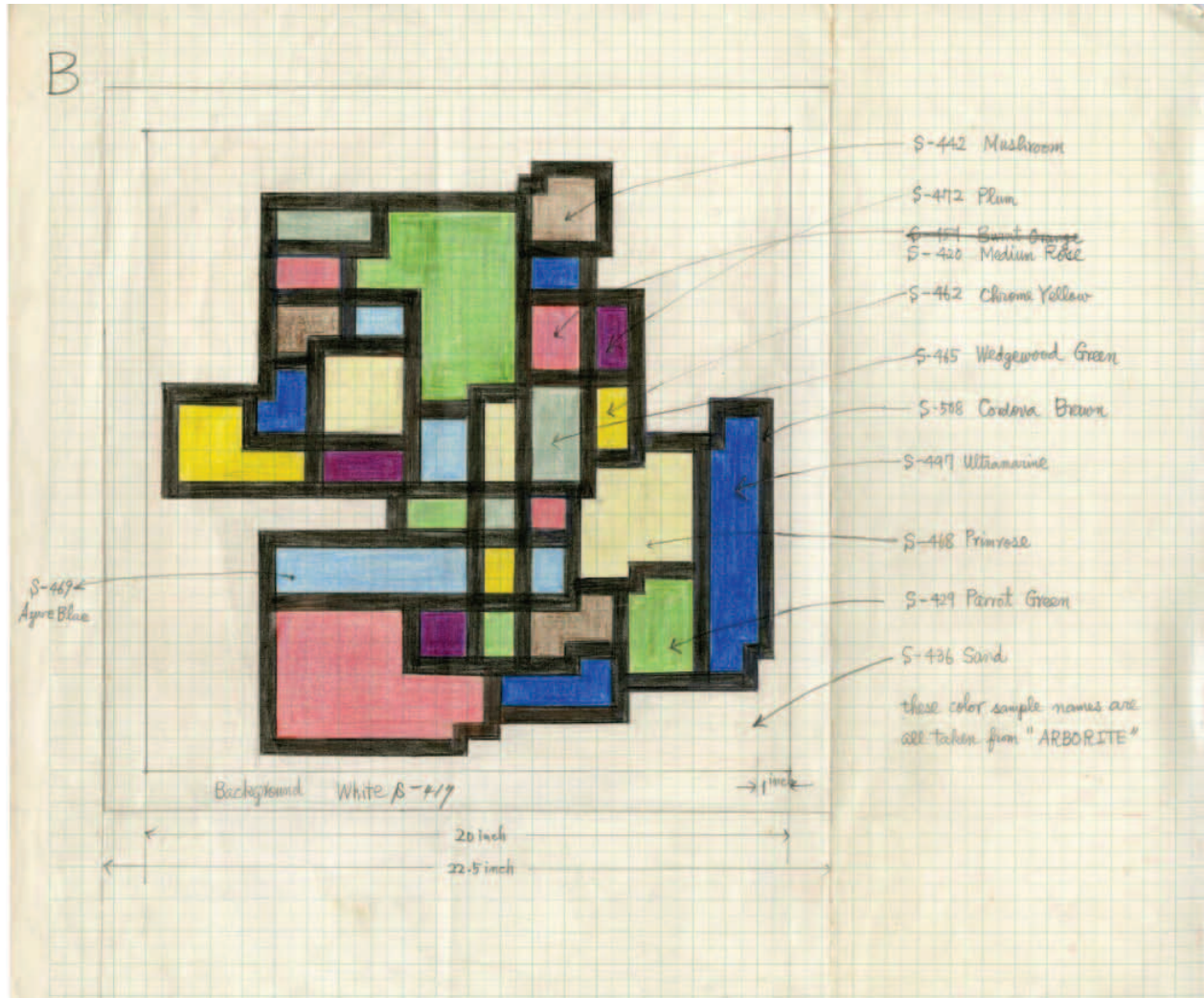
Color study, n.d. (Source: ZKM | Archives. © ZKM.) (See the article in this issue by Simone Gristwood.)