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Abstract

During the late 1960s and early 1970s a new type of collaboration between artists, scientists and engineers developed alongside the emerging field of computer art. This was an era when the computers, much larger than today, were rarely screen-based, and were almost impossible to gain access to unless it was through collaboration. In Sweden, the IBM employee and computing expert Sten Kallin entered into collaborations with a number of artists and scientists. In this article, I investigate his collaborations with the textile designer Astrid Sampe, the artist Sture Johannesson and the zoologist Mats Amundin. The perspective of this article differs from the more habitual focus on artistic motivations, as I instead approach these efforts from the collaborating computer experts' point of view, rather than the established artist collaborators. I argue that Kallin's interest in visualization was one of the driving forces that made him participate in these collaborations. I further suggest that their experimental approaches towards computing not only characterized the work of Kallin, but was significant to other computer art practitioners during this era.

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Driven by Visualization: Sten Kallin's Collaborations with Astrid Sampe, Sture Johannesson and Mats Amundin as Explorations of Computer Technology

According to the Swedish magazine *Industriell Datateknik*, the computing expert Sten Kallin's (b. 1928) work is characterized by an interest in the immense possibilities of using computers for visualization.¹ Kallin was employed within the Education Department of IBM Sweden in the early 1960s, where he mainly taught programming languages. He stayed with the company until he retired, almost thirty years later.

As an IBM employee, Kallin had more or less unlimited access to computer power. Unlike many of his colleagues in the late 1960s, he would spend evenings and weekends at IBM experimenting just for the fun of it. Subsequently, he earned the reputation of being a problem solver. IBM at that time occasionally received queries out of the ordinary concerning computer use. Although Kallin was hired as an instructor, his reputation was such that several of these queries were passed on to him. Soon he came in contact with a number of artists and scientists who were interested in the possibilities computing offered, and he began collaborating with some of them. In this article, I investigate three of his collaborations: with Swedish textile designer Astrid Sampe (1909-2002), with Swedish artist Sture Johannesson (b. 1935), and with Swedish zoologist Mats Amundin (b. 1947).

Kallin was interested in visualization, that is, using the computer for creating images.² But how is that related to his collaborations? I argue that Kallin's interest in visualization was one of the driving forces in his collaborative efforts with artists and scientists. Hence, the aim of this article is to describe and analyze Kallin's collaborations with Sampe, Johannesson and Amundin. I specifically focus on the collaboration with Sampe

and on his early collaboration with Johannesson, which both occurred in the early 1970s, and had access to the same technology and equipment. However, I will also briefly describe Kallin and Johannesson's later collaboration as well as that with Amundin, since these collaborations contribute to a deeper understanding of his work.

I will address three questions: How was the collaboration carried out? What technology was used, and how was it used? What was the role of visualization? The latter draws on a discussion of Kallin's interest in visualization in comparison to the role of visualization in recent collaborations between artists, scientists and engineers.

Kallin's collaborations with Sampe and Johannesson illustrate a type of collaboration between engineers, scientists and artists that started to appear during the 1960s. Along with the United States, Germany and the United Kingdom, Sweden was at the forefront when it came to engineers, scientists and artists exploring the use of computers for the purpose of creating art.³

The late 1960s and early 1970s could be described as a dynamic period in the history of computer art, with the birth of a number of movements, exhibitions and magazines. In Germany a group of scientists, mathematicians and artists with a mutual interest in information aesthetics formed the Stuttgart group, in Japan a number of engineers founded the Computer Technique Group, and in the United States the engineer Billy Klüver at Bell Telephone Laboratories was the driving force in the founding of Experiments in Art and Technology E.A.T., and the artist Gyorgy Kepes founded the Center for Advanced Visual Studies CAVS at the Massachusetts Institute of Technology. In the United Kingdom, reforms within the higher educational system played a major role in fostering computer art in the late 1960s and early 1970s.⁴ Universities also played

a crucial role in the computer art experiments in Australia and in Spain.⁵ Further key events in the history of computer art include the founding of the journal *Leonardo*, dedicated to the convergence of art, science and technology releasing its first issue in 1968. That same year, computer art was introduced to a wider audience by the exhibition *Cybernetic Serendipity* at the Institute of Contemporary Arts in London, and the following year *Tendencies 4: Computers and Visual Research*, at the Gallery of Contemporary Art in Zagreb, displayed computer art. In 1970 the Venice Biennale contained a special show exhibiting computer graphics.⁶

Kallin's collaborations with Sampe and Johannesson of course coincided with the emerging field of computer art. Nevertheless, it is important to remember that in those days only a few people had access to computers. Equally important to bear in mind is the fact that computers were not primarily intended for artistic intentions. On the contrary, only a limited number of artists had access to computers, and, in comparison with the established art world, computer art remained marginalized.⁷ The art historian Gary Svensson shows that Sweden witnessed a similar development, as a limited number of artists entered into collaborations with engineers and scientists during the late 1960s and early 1970s.⁸

During this period, the available equipment consisted of mainframe computers placed at military and corporate research laboratories, and within universities' computer science centres. The artist Frank Dietrich has argued that artists collaborated with computer experts during this era because they needed these experts to get access to the computers. Primarily, however, they needed the experts' programming skills.⁹

The question remains, however, as to why computer experts participated in these collaborations. The 1950s and 1960s witnessed the emergence of programming expertise. The historian of science Nathan L. Ensmenger shows that computer programmers often had an ambiguous occupational background with the reputations of being gifted individuals with “uniquely creative ability.”¹⁰ Rather than their business knowledge, it was their interest in intellectual challenges and problem solving which was of interest to their employers. Kallin belonged to this new generation of computer experts. After he earned a degree in mathematics and physics from Uppsala University in the mid 1950s, he worked as a high school teacher. However, it was not until 1962 that he came in contact with computers, when he was appointed as an educationalist in administrative data processing at The Swedish Board for Computing Machinery in Stockholm.¹¹ The following year he was hired by IBM. During the late 1960s and early 1970s, Kallin published regularly on computer programming languages, and as an IBM employee he represented the company in the Committee for Standardization on computer terminology and programming languages.¹²

Earlier writings on collaborations between engineers, scientists and artists are mainly so-called pioneer stories written by the engineers themselves. These stories focus on the kind of technology used in the art works, and there is no investigation into the driving forces behind these collaborations.¹³ Kallin’s collaboration with Sampe is mentioned in this early research, although the collaboration with Johannesson is thoroughly examined. Mainly from Johannesson’s perspective, with the aim of placing his work within an art historical context.¹⁴ Less is known about the reasons behind Kallin’s part in the collaboration.¹⁵

How does one research collaborations? Methodologically, I have used written sources such as press items, exhibition catalogues and archive material. In addition, Kallin's private archive has been an important source, containing among other things his correspondence with Johannesson, instructions to and outlines of the pictures, photographs and original prints from the plotter and the programming of the computer. These are primarily from his early collaboration with Johannesson, but also from the collaboration with Sampe. However, because of an ongoing restoration of the National Museum in Stockholm, I have not had access to the archive on Sampe that is held there. The written sources are important. However, as the historian of technology and science Per Lundin has pointed out, the knowledge of the everyday life and work of scientists and engineers is rarely revealed by the existing written sources; hence they need to be supplemented by oral sources.¹⁶ The written sources are, therefore, complemented by oral history interviews.¹⁷ Oral history, an established method, can help to locate "tacit knowledge" and allow "hidden" historical subjects to be heard.¹⁸

The structure of this article is chronological, starting with a description of the technological conditions surrounding Kallin's collaborations during the 1970s, then followed by an examination of each of the collaborations, respectively. Finally, the concluding discussion contains a comparison between Kallin's interest in visualization and the role of visualization in recent collaborations.

Technological background: IBM 1130 and Calcomp drum plotter

The 1960s was the era of mainframe computers which used punch cards to enter program code. These computers were large, and were usually not at the same site as the programmer, who often had to wait hours or even days for the outcome of the programming. Thus, there was usually physical distance between the computer and the

user, but towards the end of the 1960s something happened. A new kind of computer was introduced, referred to as the minicomputer. This was a small, low-priced computer for scientific or technical applications. Moreover, the minicomputer was interactive, meaning it was small enough to be placed on a desk, which in turn implied that the user could sit next to it, program it and receive an immediate response by connecting a printer to the computer. Compared to mainframe computers, this implied a different and more “hands-on” type of computing, and allowed for experimental approaches. This accessibility meant new possibilities for those interested in computer art, and computer art experiments in the United Kingdom and Australia were mainly due to the development of minicomputers.¹⁹

At IBM, Kallin had access to the IBM manufactured computer 1130. It is possible to describe IBM 1130 as a forerunner of the minicomputer. It was a low-priced, rather small computer for scientific applications that was introduced in the mid-1960s. The computer had a built-in keyboard and received information through punch cards, punch tapes or the console keyboard of the central unit, and its programming language was Fortran. It is important to remember that computers were rarely screen-based in those days, and the visualization devices we take for granted today did not yet exist.²⁰ As the computer was screenless, the only output unit Kallin had access to was a Calcomp drum plotter that could be plugged into the computer. The plotter had a paper width of approximately 30 centimetres and a pen holder. While printing, the paper roll rotated back and forth around the drum, and the pen holder moved sideways. This resulted in somewhat jagged lines: since the pen in the holder was slightly loose, it vibrated as it created each line.

The comparatively small size of the computer meant that Kallin was able to place it on a desk, sit directly by it, feed it data through its built-in keyboard, and watch the outcome of the programming as it became visible on the plotter's paper (Fig. 1). Since Kallin thought "the computers during the 60s were useless as they could not draw the slightest thing,"²¹ he privately began to experiment with the computer and printer during evenings and weekends when it was not being used for regular work. According to Kallin, no one else at IBM had any clue of what to do with either the computer or the plotter, or showed any interest in it, for that matter.

But I thought it was great. I could use it for drawing things, and I wrote a couple of exercise programs in Fortran. I was thus amused by how one could make the computer draw pictures. I wrote something where one draws x and y axes and graphic diagrams, or bar charts. It was rather simple. But I thought it would be fun to do something else, another more interesting graphic output.²²

Astrid Sampe: Computer roses, postal horns and computer colonnes

According to Kallin, Astrid Sampe contacted IBM in late 1969 or early 1970. Her request ended up with Kallin, and he was asked by IBM as to whether he could talk to her since "she wants to draw something strange with computers, and we do not have the slightest clue who we should talk to."²³

Sampe is known for her experimental approach to textile design, as well as her interest in new technologies, and before contacting IBM she had already become acquainted with computer technology through her visit to *Cybernetic Serendipity* in London.²⁴ Sampe had been asked to create something for a charity auction for the Red Cross, and she therefore approached IBM. According to Kallin, her desire was to begin with the Red Cross

symbol, but to render it differently than it usually appeared. “She wanted to be modern, use the computer, ‘and as computers are great, why don’t you tell the computer to draw something interesting’,” Kallin remembers.²⁵ But how could Kallin make the computer draw something interesting?

I thought that this pen that draws was nice. It was a little loose in its holder, which meant that the line that comes out is not particularly mathematical. It is as if it is somewhat human, or like there is some character or something random in the line. And if one places several lines next to each other, this is intensified by the moiré effect that arises when one has several lines next to each other, particularly if they do not have the same angle.²⁶

Kallin wrote a program that rendered the symbol of the Red Cross. He created a menu in which one could feed in data controlling how many symbols to draw, how many turns and angles it should include, and how much percentage to scale down. When this was done, Sampe came to IBM one evening and Kallin taught her how to feed data into the computer. She used the computer and the plotter and by the time she left she had a number of prints of the Red Cross symbol depicted in various ways. According to Kallin, IBM did not charge Sampe for using the computer, or for the prints.²⁷ In March 1970, Sampe’s work was sold at the Red Cross charity auction.²⁸ However, she continued to use the prints for her pattern production, and shortly afterwards, slightly later that same year, *Computer Rose* was printed on fibreglass fabric. Kallin eventually received a piece of fabric with the pattern.

Sampe contacted Kallin two more times. The second time she contacted him was because she had been given a new commission she wanted to use the computer on – it

was a cover depicting a postal horn. Like the previous time, Kallin wrote a program and Sampe came to IBM where she conducted the work in a similar manner. Her third request, however, was not initiated by a commission, but originated, according to Kallin, from her interest in the computer. Kallin began with the sine curves he had been elaborating on earlier, and wrote a program. Once again Sampe came to IBM to use the computer and the plotter.²⁹ One of the outcomes was the pattern *Computer Colonne* from 1975.

Kallin and Sampe collaborated on three occasions, and each time the process was rather similar. But which tasks was Kallin involved in? And which tasks did he not participate in? Kallin was only involved in the parts that included the computer and the plotter. He wrote a program and instructed Sampe on how to use it. However, he was not involved in any further processes as Sampe adapted the prints for her pattern design.

Two factors in their working process are significant here: first, how Kallin transformed visual form into mathematical expression, and, second, his use of the conditions of using computer technology. Concerning the program Kallin wrote to have the computer draw a postal horn, he states: “It was mathematical in a way. I have always found that amusing, to discover the mathematical expression of a complicated form.”³⁰ Kallin’s description of the program used for the *Computer Colonne* serves as another example. When asked to describe the pattern, he explains “it is really only a strongly disturbed sine curve that is drawn symmetrically and repeated many times, using gradually reduced amplitude. This produces a kind of three dimensional effect.”³¹ As Kallin tried to figure out how to manage Sampe’s request, he began with the conditions set by computer technology, particularly the conditions of the plotter. In writing the program, he began with the jagged and vibrating line that arose as a result of how the plotter functioned (Fig. 2).

That particular jaggedness in the line has recieved attention from Kerstin Wickman, who claims that it gives Sampe's computer pattern a "vibrating intensity."³² However, since the IBM 1130 was screenless, it does not depend on "the screen's insufficient resolution," as Wickman argues – it was because of the plotter. In a 1970 interview, Sampe emphasizes the fact that initially they were supposed to continue their work on a screen-based device. But since she was interested in the results from the plotter in general, and the jaggedness of the line in particular, they continued to use the plotter.³³ Earlier research has looked at Sampe's use of computers in producing her patterns, but with only a few exceptions, IBM rather than Kallin specifically is indicated as her collaborator.³⁴

Sture Johannesson: Intra and EPICS

In February 1971, the Information Department of IBM put Kallin in contact with the artist Sture Johannesson. Kallin was asked to devote approximately four hours in helping Johannesson with his planned work on an IBM 1130.³⁵ Johannesson's prime medium was the poster, but he had also worked with photography, film and leaflets.³⁶ He contacted IBM because he was interested in continuing to elaborate on a picture alphabet he developed during the mid 1960s that consisted of different symbols, e.g. a key, a heart and the combination of both.³⁷ Like the request from Sampe, Johannesson's inquiry was also considered rather odd – thus, it was passed on to Kallin. However, the work did not restrict itself to the four hours initially suggested, but instead marked the beginning of a longtime collaboration and friendship that led to the projects Intra and EPICS.

Initially, their working process was equivalent to that between Sampe and Kallin. After their initial contact, Johannesson came to IBM where they used a program Kallin had

written. Kallin taught him how to feed data into the computer and print on the plotter, and when Johannesson left he took a number of prints that he continued to experiment with. Kallin later received various posters Johannesson had made by combining different prints, and by adding elements and colours. Based on Johannesson's correspondence with Kallin it may be concluded that they continued their collaboration by discussing motifs for which Kallin was to write programs. Communication of the ideas took place in part by them exchanging hand-drawn outlines, but they also wrote letters, made phone calls and met in person, since Johannesson travelled to Stockholm occasionally.³⁸

Johannesson also was occasionally given commissions that he wanted to realize by using the computer. For instance, in the mid 1970s he was asked to create a record cover and a poster for the Swedish musician Peps Persson, and he turned to Kallin.

At that time I was still using the plotter frequently and thought it might be fun to try to draw what is essential on a record, the soundtrack. I drew one single spiral but I made it so I could modify the spiral to lift the text, and to move the pen a little up and to the left on the letters "PEPS". [...] There was no attempt whatsoever to make it look like a real soundtrack. But it was one spiral and I could select the distance between each rotation. The close spacing of the rotations produced second order surface patterns, moiré effects that are quite interesting. And their characteristics depend on the distance between the rotations.³⁹

Kallin mentions that he drew only one spiral, which means that he created the print using one single line. This is vital in understanding how he used the technology: the same line created both the letters "PEPS" and the surrounding spiral. Thus, "to lift the text" and "move the pen" does not mean that Kallin literally moved the pencil in the plotter – which he could have done, and which would have been easier. Instead he wrote a

program that made the text look *as if* it was lying above the background, although the picture only consists of one single line (Fig. 3). Furthermore, Kallin and Johannesson made use of the fact that the pencil vibrates as the plotter turns. This implied that the line did not become entirely straight, but instead became “a vibrating line, random, it became slightly less dead,” Kallin explains.⁴⁰ Regarding a spiral pattern they developed for a picture called *Spirals*, Kallin states that the line is not “exactly mathematical, but you can see a vibration in the movement that we deliberately took advantage of since it becomes a much better picture if the line is not mathematically exact.”⁴¹ The art historian and curator Lars Bang Larsen pays attention to the vibrations in the line as an effect of how the plotter works, and implies that Kallin and Johannesson investigated the potential of the medium.⁴²

As Kallin made use of and investigated computer technology, he took his starting point in the inherent qualities of the plotter. This becomes even more striking as he describes the final posters. A recurrent tendency in Kallin’s account of how the pictures are created is that he makes a distinction between what is possible to accomplish by programming the computer and by printing on the plotter on the one hand, and, on the other hand, what has been added to the picture by using another technique. Concerning one of the pictures from *Intra*, he says that “then he [Johannesson] added that [brown line]. And that has of course nothing to do with the computer. It is only a printed element.”⁴³ And regarding the composition of a poster for the football club Landskrona Bois that consisted of two different prints created by different programs, he states that “[t]he computer is not involved at all”⁴⁴ in putting together the final poster. Yet another important aspect seems to be the fact that it is Johannesson – and not Kallin – who has continued the work with the prints and thus he who created the final pictures.

Concerning *Computer Paragraph*, a computerized picture of a paragraph, Kallin tells, “he

[Johannesson] has put together three different prints from the plotter in a way that it cannot be seen as to where one starts and the next one ends.”⁴⁵ Regarding the line in *Spirals*, Kallin says “it is two variations that he has put together in a way so that it only becomes one curve,”⁴⁶ and concerning the poster for Peps, Kallin states: “but this is the only thing that I made,”⁴⁷ referring to the original print from the plotter. The examples illustrate the working process, showing that Kallin is involved in the elements that are directly related to the computer and the plotter, whereas Johannesson constructs the final posters.

In the section on Sampe, I indicated Kallin’s interest in finding the mathematical expression of a complicated form. This is also articulated by the outlines he made before writing the computer programs. One example of an outline from *Computer Paragraph* is reproduced in figure 4. The picture depicts a sign of a paragraph in blue felt pen, drawn by hand. A closer look reveals circles, angles and a marked centre line along with calculations written in pencil. The picture illustrates how Kallin deconstructed the sign of the paragraph into mathematical expressions. A similar example can be found in the programming of the picture *Yin Yang*. In this instance, Kallin drew a handmade outline of the figure, showing how he deconstructed the graphic form into mathematical expressions, partially described in the programming text (Fig. 5, 6 and 7).

The art historian Grant D. Taylor has pointed out that the same type of mathematical-inspired visualizations that Kallin was interested in was also prevalent among computer art practitioners in the late 1960s. Geometric forms, sine curves and moiré patterns or effects were among the popular patterns used, and, continues Taylor, these became even more visually attractive with the development of the plotter.⁴⁸ For instance, the British programmer John Vince at Middlesex Polytechnic conducted work similar to Kallin’s

and used the same type of plotter. And like Kallin, Vince used his programming skills to help artists, and was, according to the art historian Catherine Mason, interested in computing for “visual purposes.”⁴⁹ Kallin’s explorations of visualization should thus be understood in relation to a broad comparative framework of computer art. Some of the computer graphics he created with Johannesson were exhibited internationally, for instance, at *Tendencies 5* in the section “Computer visual research” in the Gallery of Contemporary Art in Zagreb in 1973.

From 1979 through 1983, Kallin worked at the IBM educational centre La Hulpe in Brussels. He was teaching, and he built up the graphics department, developing graphics programs for producing slides, among other things.⁵⁰ During the mid 1980s, he joined the Swedish Computer Graphics Association, Sigrad, where he was a permanent member of the board for a decade.⁵¹

Kallin and Johannesson remained in contact, and by 1986 they had begun their second project, EPICS, Exploring Picture Space. The starting point was to let simple graphic elements on a picture space be surrounded with a kind of aesthetic tension field. “And I would like to elaborate on this field and graphically visualize it,” as Kallin summarized the primary goal of the project.⁵² The technological conditions of EPICS were different in two significant ways from those at Intra: first, the personal computer had been introduced, and, second, computer screens were more common by that time. The project was conducted on a personal computer from IBM, referred to as PC/AT, AT meaning advanced technology, and on a computer screen called IBM Professional Graphics Display. Due to the change in technological conditions, Johannesson did not have to come to IBM to use the computer. Instead, he was now able to conduct the work at his home in Malmö by using the computer and display he had borrowed from IBM.

Furthermore, using a screen meant that the result of the programming was immediately visible. These differences also affected their working process.

One of the main offshoots of EPICS was the computer program Fields.⁵³ Kallin wrote Fields by using the programming language Basic. Kallin and Johannesson developed Fields together, and they exchanged and discussed ideas. “For me, it was an interesting laboratory. I was able to put everything in it. And I tried out my ideas and graphic techniques and all that,”⁵⁴ Kallin explains. Gradually Fields turned into a common working- and developing environment, as it became a program used for all sort of things. The development and use of Fields has a number of international counterparts, all aiming at facilitating communication between the artist and the programmer.⁵⁵ Kallin was not involved in the further process of creating pictures within EPICS.

In 1987, Kallin was appointed Senior Technical Staff Member. This title was given to people within IBM who had made remarkable achievements within technology and who were internationally renowned as authorities within their fields. According to the internal magazine *IBM Kontakt*, this meant that Kallin was expected to keep himself informed about cutting edge developments in his special areas: programming languages, methods for applications and graphic, technological and scientific applications.⁵⁶ This mark of honour gave him almost a free hand when it came to his daily work.

Mats Amundin: Dolphin heads

The last of Kallin’s collaborations which I will investigate in this article is that with the zoologist Mats Amundin, employed at Kolmården. Amundin approached IBM during the mid 1980s, when he was working on a dissertation on sound production in dolphins. To be able to look into dolphin heads and determine how sound was created, he needed

help. Like the inquiries from Sampe and Johannesson, Amundin's query was also outside the usual scope of IBM, and hence it was passed on to Kallin, who was to help Amundin with a graphic presentation of how dolphins create sounds.⁵⁷

Had it been today, Amundin would probably have used standard equipment for medical imaging techniques or a 3D-scanner. "But it was not today,"⁵⁸ Kallin states whilst giving an account for the technological equipment available at that time. The absence of adequate technical equipment contributed to Kallin taking on the problem.⁵⁹

Which technology did Kallin actually have access to? "We had recently gained access to a good screen [...] as an addition to the PC. And no one cared about it, and I thought it was really sad, I wanted to do something interesting with it,"⁶⁰ Kallin explains. The screen Kallin refers to, and that he used in the collaboration with Amundin, was an IBM Professional Graphics Display attached to an IBM PC/AT.⁶¹

Amundin used frozen dolphin heads that he cut to one millimetre wide slices. In order to augment the colours of the different organs, the slices were daubed with methanol, then photographed and developed as slides.⁶² While trying to figure out how to make something out of the slides, Kallin got the idea to put a slide projector on the high bookcase next to the desk. Using an inclined mirror, the images were projected on a digitizing table on the desk, and by inserting the slides in reverse, the correct image was produced on the tablet. Kallin's next step was to write a program that made it possible for Amundin to digitize what was interesting to him, accordingly a number of measurement points describing the place in the slide and in the organ. Kallin wrote a program for three-dimensional generation. He used the programming languages Quick Basic and C.⁶³

Sten Kallin hired his son Erik Kallin to write the digitizing program. They wrote a computer graphics program for reconstructing the anatomical structures of the dolphins, showing the slides in three-dimensional images and in stereo. The colours showed the different organs that Amundin had marked out. Kallin wrote all the software, and as he himself notes, “there was nothing, the system was naked. Today there is a lot of software, but this was a long time ago.”⁶⁴ When this was done, Amundin could turn the head in all different directions, view it in stereo, and examine it from various angles. The outcomes of the collaboration were the computer program and Amundin’s dissertation at the zoological department of Stockholm University.⁶⁵

Kallin’s disappointment concerning that no one cared about the screen has similarities to the way he expressed his interest in the computer he used during the 1970s. That the computer was placed in a box room made him ponder: “and that was of course sad, such a nice machine.”⁶⁶ And while thinking about how to solve Sampe’s request to make the computer draw something interesting he asked himself: “how does one make my poor 1130 clever enough to draw something interesting?”⁶⁷ Similar to what Taylor refers to as an international trend of “humanizing and personifying the computer”⁶⁸ beginning in the late 1960s, Kallin reveals an attitude towards the computers that almost has the character of a personal relationship. According to the computer scientists Martin Campbell-Kelly and William Aspray, this particularly applied to the users of the minicomputer.⁶⁹

Although it might be concluded that the collaborations were more or less dependent on Kallin’s personal interest in visualization, I would like to reflect on the reasons IBM participated. Why was Kallin allowed to use the company’s equipment for his collaborations? In the case of Johannesson, Bang Larsen has argued that IBM was

probably aware of the PR-value of “a genuine psychedelic hipster.”⁷⁰ That is likely the case. However, these were not the only collaborations IBM supported. On the contrary, historically the company has supported computer art in various ways. Therefore, I would like to propose an alternative response, suggesting that these kinds of collaborations contributed to technological development.⁷¹ Thus, for IBM, Kallin’s involvement in these collaborations was not only a question of PR, but also of technological progression.

Visualizing with the help of computer technology

In this article, I have described and analyzed Kallin’s collaborations with Sampe, Johannesson and Amundin, with particular focus on the working process as well as the technology used. In all three collaborations, Kallin was involved in the parts related to the use of the computer, whereas the collaborating partners then continued elaborating on the material created by the programming. Concerning the technological equipment, I have demonstrated that Kallin both used and investigated the inherent qualities of the computer as well as the plotter.

How is it possible to use the insights made from the description of the working process and Kallin’s use of the technological equipment in order to better understand the collaborations as a way for Kallin to explore visualization? One approach would be to discuss the role of visualization in Kallin’s collaborations in relation to the role of visualization in recent collaborations between scientists and artists. For instance, a recurrent interpretation among art historians, scientists and artists is that art has become an interpreting link between science and the public. Due to its increased complexity, science is supposed to use art as it turns the complex questions and results of science into visual presentations.⁷²

Contrary to what I have shown in this article, such an interpretation implies that the technology is used as a tool in order to achieve knowledge about something else. This is significantly different from Kallin's interest in visualization as he instead – to put it simply – used the computer to understand the computer. The difference between these approaches might be understood in relation to what the artist and engineer Stephen Jones addresses as “the rolling new.”⁷³ The phenomenon refers to the continued development of new technologies, and how it repeatedly offers artists opportunities to search for technological novelty. Jones researches on early computer art experiments in Australia, and is particularly interested in artists' use of a technology during the period in which it has not yet reached maturity. Kallin experimented with the computer during this period, whereas today's art and science collaborations often tend to use science and technology devices that have already reached a mature phase.

In a comparison between computer users in the late 1960s and early 1970s and today, visual communication researcher Brent MacGregor argues that the latter “are less likely to do something just to see if it can be done.”⁷⁴ Even if Kallin's approach towards the computer in general and his collaborative commitments in particular does not indicate anything about computer users today, it does serve as an illustrative example of the experimentation which characterized computer art from the late 1960s and early 1970s. Like many of his fellow computing experts, Kallin was above all interested in what the computer was able to do. To him, it was not a question of creating an aesthetic expression regardless of procedure, but instead one of exploring the immense possibilities of using computers for visualization. Kallin's artistic collaborations gave him an opportunity to do this.

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Suggested figures

Fig. 1 Sten Kallin (left) and Sture Johannesson (right) at the IBM 1130 and Calcomp drum plotter at IBM in Stockholm in the early 1970s. Courtesy of Sten Kallin and Sture Johannesson.

Fig. 2 Detail of original print from the Calcomp drum plotter in the early 1970s. Courtesy of Sten Kallin.

Fig. 3 Original prints from the Calcomp drum plotter and the final poster for Peps Persson. Installation view from Sture Johannesson's exhibition *In Memory* at Index in Stockholm, 2013. Photo: Anna Orrghen.

Fig. 4 Outline for the *Computer Paragraph*. Blue felt pen and pencil on paper. Early 1970s. Courtesy of Sten Kallin.

Fig. 5 Outline for *Yin Yang*. Pencil on paper. Early 1970s. Courtesy of Sten Kallin.

Fig. 6 Programming sheet and outline for *Yin Yang*, 1972. Courtesy of Sten Kallin.

Fig. 7 *Yin Yang*, 1975. Courtesy of Sture Johannesson.

¹ Christer Åkerman, "Dekorerad IBMare gör vad han vill", *Industriell Datateknik*, No 1, 1989, p. 26.

² Besides Kallin's own publications on the subject, e.g. Sten Kallin, "Utbildning inom och med datorgrafik", in Mats Lenngren, Thomas Pettersson, Michael Pääbo and Ewa Attebo (eds.), *Datorgrafikdagar 7-9 juni 1983. Kursdokumentation del II*, Linköping: Tekniska

högskolan i Linköping, 1983, pp. 163-169; Sten Kallin, "The Nature of Fractals", *SIGRAD-Bulletinen*, No 26, 1986, pp. 4-8; Sten Kallin, "Experiences with the Image Interactor", *SIGRAD-Bulletinen*, No 44, 1993, pp. 14-19; Sten Kallin, "The EPICS project: Exploring Picture Space 1986-1998", in *Sture Johannesson: Lund Konsthall*, Lund: Lunds konsthall, 2004, pp. 90-92, it recieved attention in press items, see *Modern Datateknik*, "Plottrande formgivare gör morgondagens design", No 11, 1970, p. 35; *Modern Datateknik*, "Datamaskinerna demokratiserar", No 14, 1972, p. 20; *IBM Kontakt*, "Sten Kallin utnämnd till Technical Staff Member", June/July 1987; Åkerman, 1989, as well as in the literature, see Gary Svensson, *Digitala pionjärer: Datakonstens introduktion i Sverige*, Stockholm: Carlsson, 2000, pp. 57-58, 92-100; Lars Bang Larsen, *Sture Johannesson*, New York: Lukas & Sternberg, 2002, pp. 59-63, 96.

³ The development in Sweden received attention from Douglas Davis, *Art and the Future: A History/Prophecy of the Collaboration Between Science, Technology and Art*, New York: Praeger Publishers, 1973, p. 97. See also Marga Bijvoet, *Art as Inquiry: Toward New Collaborations Between Art, Science, and Technology*, New York: Peter Lang, 1997, pp. 15, 31, and Siri Bjurwill and Vanessa Ware, "Sweden: Unseen scenes", in Minna Tarkka and Mirjam Martevo (eds.), *Nordic Media Culture: Actors and Practices*, Helsinki: M-Cult, Centre for New Media Culture, 2003, p. 81.

⁴ Catherine Mason, *A Computer in the Art Room: The Origins of British Computer Arts 1950-80*, Hindricham: JIG, 2008.

⁵ On the development in Australia, see Stephen Jones, *Synthetics: Aspects of Art and Technology in Australia, 1956-1975*, Cambridge, MA: MIT Press, 2011, especially chapter 4. On Spain, see Eva Moraga, "The Computation Center at Madrid University, 1966-1973: An Example of True Interaction between Art, Science, and Technology", in Andreas Broeckmann and Gunalan Nadarajan (eds.), *Place Studies in Art, Media, Science and*

Technology: Historical Investigations on the Sites and the Migration of Knowledge, Weimar: VDG, 2008, pp. 47-53.

⁶ For an overview of the period, see for example H.W. Franke, *Computer Graphics: Computer Art*, London: Phaidon, 1971; H.W. Franke, “Computers and Visual Art”, *Leonardo*, No 4, 1971, pp. 331-338. Paul Brown, Charlie Gere, Nicholas Lambert and Catherine Mason (eds.), *White Heat Cold Logic: British Computer Art 1960-1980*, Cambridge, MA: MIT Press, 2008; Margit Rosen, (ed.), *A Little Known Story About a Movement, a Magazine, and the Computer’s Arrival in Art: New Tendencies and Bit International, 1961-1973*, Karlsruhe: ZKM/Center for Art and Media, 2011; Hannah B Higgins and Douglas Kahn (eds.), *Mainframe Experimentalism: Early Computing and the Foundations of Digital Arts*, Berkeley: University of California Press, 2012; Grant D. Taylor, *When the Machine Made Art: The Troubled History of Computer Art*, New York: Bloomsbury Academic, 2014; Francesca Franco, “The First Computer Art Show at the 1970 Venice Biennale: An Experiment or Product of the Bourgeois Culture?”, in Sean Cubitt and Paul Thomas (eds.), *Relive: Media Art Histories*, Cambridge, MA: MIT Press, 2013, pp. 119-134.

⁷ Grant Taylor, “The Soulless Usurper: Reception and Criticism of Early Computer Art”, in Brown et al. (eds.), 2012, p. 32.

⁸ Svensson, 2000, especially chapter 2.

⁹ Frank Dietrich, “Visual Intelligence: The First Decade of Computer Art”, *Leonardo*, No 19, 1986, p. 162.

¹⁰ Nathan L. Ensmenger, “Letting the ‘Computer Boys’ Take Over: Technology and the Politics of Organizational Transformation”, *International Review of Social History*, No 48, 2003, p. 158.

¹¹ The Swedish Board for Computing Machinery was a Swedish government agency which developed and built Sweden's first two computers. The agency was established in 1948 and closed down in 1963.

¹² Examples of this are the recurrent articles under the headline "Lär mer om programspråk" published in the magazine *Modern Datateknik* during the second half of the 1960s. In 1967 Kallin published a manual of the programming language Fortran, Sten Kallin, *Lärobok i Fortran*, Lund: Studentlitteratur, 1967, and in 1971 a manual of the programming language PL/1, Sten Kallin and Christer Odén, *Lärobok I PL/1*, Lund: Studentlitteratur, 1971.

¹³ For an overview of earlier research, see Anna Orrghen, "Surveying the Literature on Technoscience Art: From Pioneer Stories to Collaborations as the Objects of Study" (article submitted to *Digital Creativity*. Reviewed).

¹⁴ See Svensson, 2000, and Larsen, 2002.

¹⁵ Also see Anna Orrghen, "Collaborations Between Engineers and Artists in the Making of Computer Art in Sweden 1967–1986," in John Impagliazzo, Per Lundin and Benkt Wangler (eds.), *History of Nordic Computing 3. The Third IFIP WG 9.7 Working Conference, HINC3, Stockholm, Sweden, October 2010. Revised Selected Papers*, Heidelberg: Springer, 2011, pp. 127-136.

¹⁶ Per Lundin, *Computers in Swedish Society: Documenting Early Use and Trends*, New York: Springer, 2012, pp. 22-25.

¹⁷ I have conducted interviews with Sten Kallin in 2007, 2011 and 2013. The interviews are in the possession of the author. The interview from 2007 is also available at <http://www.tekniskamuseet.se/1/261.html> (accessed March 6, 2015).

¹⁸ See Alessandro Portelli, *The Death of Luigi Trastulli and Other Stories: Form and Meaning in Oral History*, Albany, N.Y.: State Univ. of New York Press, 1991, and Robert Perks and Alistair Thomson (eds.), *The Oral History Reader*, 2nd ed., London: Routledge, 2006.

¹⁹ On minicomputers, see Paul E. Ceruzzi, *A History of Modern Computing*, 2nd ed., Cambridge, MA: MIT Press, 2003, pp. 124-136, 191-193, and Martin Campbell-Kelly and William Aspray, *Computer: A History of the Information Machine*, Boulder, CO: Westview Press, 2004, pp. 198-202. On the use of minicomputers in the United Kingdom, see Charlie Gere, “Minicomputer Experimentalism in the United Kingdom from the 1950s to 1980s, in Higgins and Kahn (eds.), 2012, p. 112-127, on Australia, see Jones, 2011, chapter 4.

²⁰ Although screens started to appear during the mid 1960s, they remained rare throughout the decade and it was not until the 1970s that computer screens became generally accepted. Pugh W. Emerson, Lyle R. Johnson, John H. Palmer, *IBM's 360 and Early 370 Systems*, Cambridge, MA: MIT Press, 1991, pp. 598-608. See also Tord Jöran Hallberg, *IT-gryning: Svensk databistoria från 1840- till 1960-talet*, Lund: Studentlitteratur, 2007, p. 280.

²¹ Kallin, 2007.

²² Kallin, 2007.

²³ Kallin, 2007.

²⁴ *Modern Datateknik*, 1970, p. 35.

²⁵ Kallin, 2007.

²⁶ Kallin, 2007.

²⁷ Kallin, 2007. This working process is also described in *Modern Datateknik*, 1970, p. 35.

²⁸ Memo to Sten Kallin from Eva Wiberg, dated March 13, 1970. Sten Kallin's private archive.

²⁹ Kallin, 2007; Kallin, 2011.

³⁰ Kallin, 2007.

³¹ Kallin, 2007.

³² Kerstin Wickman, "Pionjärerna", in *17 svenska formgivare: Chez Pascale*, Stockholm: Langenskiöld, 2007, p. 265.

³³ *Modern Datateknik*, 1970, p. 35.

³⁴ *Astrid Sampe: Svensk industritextil*, Stockholm: Nationalmuseum, 1984; Carolina Söderholm, *Svenska formgivare*, Lund: Historiska media, 2005, pp. 91-99, 224; Ann Marie Herlitz-Gezelius, *Ären som gått*, Lund: Signum, 1992, pp. 127-150. On Kallin as the collaborating partner, see Svensson, 2000, pp. 46, 58, and Lesley Jackson, *Twentieth-Century Pattern Design: Textile and Wallpaper Pioneers*, New York, N.Y.: Princeton Architectural Press, 2002, p. 170.

³⁵ Memo from Lennart B Larsson to Sten Kallin dated February 17, 1971. Kallin's private archive. The memo from Larsson indicates that Kallin and Johannesson's collaboration started slightly later than earlier sources have claimed, where it was dated to 1969-1974. See Svensson, 2000, p. 92, Orrghen 2011, p. 130.

³⁶ Folke Edwards, "Svenskt 60-tal: Eufori och indignation", in *Nordiskt 60-tal: Uppbrott och konfrotation*, Helsingfors: Nordiskt konstcentrum, 1990, p. 171. For a thorough analysis of Johannesson's posters, see Lars Bang Larsen, *A History of Irritated Material: Psychedelic Concepts in Neo-Avant-Garde Art*, Copenhagen: Faculty of Humanities, University of Copenhagen, 2011, especially chapter 1.

³⁷ Letter of recommendation from Pontus Hultén dated July 3, 1970, Kallin's private archive. On the picture alphabet as motifs in Johannesson's posters, see Leif Nelson, "'Peace in our space': Sture Johannesson och Bilden som ord", *Studiekamraten*, No 7, 1979, p. 29.

³⁸ Discussions of the working process are prominent in the correspondence between Johannesson and Kallin. This can also be seen in the hand-drawn outlines and calculations made by Kallin. Kallin's private archive. See also *Modern Datateknik*, 1972, p. 20; Kallin 2007; Kallin 2011; Kallin 2013.

³⁹ Kallin, 2011.

⁴⁰ Kallin, 2011.

⁴¹ Kallin, 2007.

⁴² Larsen, 2002, p. 61.

⁴³ Kallin, 2011.

⁴⁴ Kallin, 2011.

⁴⁵ Kallin, 2011.

⁴⁶ Kallin, 2007.

⁴⁷ Kallin, 2011.

⁴⁸ Taylor, 2014, pp. 70-74.

⁴⁹ Mason, 2008, p. 148.

⁵⁰ Åkerman, 1989, p. 26; Svensson, 2000, p. 58.

⁵¹ Lars Kjeldahl, "Fragments from the Swedish History of Computer Graphics with SIGRAD", in Anders Hast (ed.), *SIGRAD 2007: The Annual SIGRAD Conference: Special Theme: Computer Graphics in Healthcare, November 29–30, 2007 Uppsala, Sweden: Conference Proceedings*, Linköping: Linköping University Electronic Press, 2007, pp. 39-41.

⁵² Kallin, 2007. See also Sture Johannesson, "Om gränser och andra snitt: Föredrag för Dataföreningen i Sverige, Malmö Börshus, 27 10. 1992", *SIGRAD-Bulletinen*, No 43, 1992, pp. 10-14, and Svensson, 2000, pp. 92-100.

⁵³ Svensson even implies that the project EPICS and the computer program Fields could be considered to be identical. Svensson, 2000, p. 96.

⁵⁴ Kallin, 2011.

⁵⁵ For instance, at Middlesex Polytechnic the programmer John Vince developed the computer program PICASO, at the Basser Computing Department at the University of Sydney, Doug Richardson developed a computer instrument which easily allowed artists to use the computer, and at Bell Telephone Laboratories the engineer Ken Knowlton created new languages in his collaborations with artists. See John Vince, “PICASO at Middlesex Polytechnic”, in Brown et al. (eds.), 2008, pp. 261-275; Jones, 2011, pp. 81-94; Ken Knowlton, “Collaborations with Artists — A Programmer's Reflections”, in F. Nacke and A. Rosenfeld (eds.), *Graphic Languages. Proceedings of the IFIP Working Conference on Graphic Languages*, Amsterdam: North Holland Publishing Company, 1972, p. 401.

⁵⁶ *IBM Kontakt*, 1987, p. 2.

⁵⁷ Kallin, 2007. Their collaboration was noted in *IBM Kontakt*, “Delfinspråket kartläggs med hjälp av CAD/CAM”, June 1984, p. 16.

⁵⁸ Kallin, 2007.

⁵⁹ Kallin, 2007.

⁶⁰ Kallin, 2007.

⁶¹ Mats Amundin, *Sound Production in Odontocetes, With Emphasis on the Harbour Porpoise, Phocoena Phocoena*, Stockholm: Department of Zoology, Stockholm University, 1991, pp. 13-14.

⁶² Amundin, 1991, p. 126.

⁶³ Kallin, 2007.

⁶⁴ Kallin, 2007.

⁶⁵ Amundin, 1991. One of the dissertation's seven papers was co-authored by Amundin, Sten Kallin and Erik Kallin. See Mats Amundin, Erik Kallin and Sten Kallin, “The Study of the Sound Production Apparatuses in the Harbour Porpoise, Phocoena Phocoena,

and the Jacobita, *Cephalorhynchus Commersoni*, by Means of Serial Cryo-microtome Sectioning and 3-D Computer Graphics”, in Amundin, 1991, pp. 41-45. For a detailed description of the method used for creating the reconstructions, see Mats Amundin and Ted Cranford, “Forehead Anatomy of *Phocoena Phocoena* and *Cephalorhynchus Commersonii*: 3-dimensional Computer Reconstructions with Emphasis on the Nasal Diverticula”, in Amundin, 1991, pp. 49-60 [especially 51-52]. See also Amundin, Stockholm, 1991, pp. 13-14.

⁶⁶ Kallin, 2007.

⁶⁷ Kallin, 2007.

⁶⁸ Cf. Taylor, 2014, p. 120-121.

⁶⁹ Campbell-Kelly and Aspray, 2004, p. 201.

⁷⁰ Bang Larsen, 2002, p. 60.

⁷¹ For earlier research arguing that this was the case, see for instance Douglas Kahn, “James Tenney at Bell Labs”, in Higgins and Kahn (eds.), 2012, pp. 131-146, in which Kahn researches the composer James Tenney, who was an artist in residence at Bell Telephone Laboratories, and argues for Tenney’s contribution to engineering. See also Paul Brown, “From Systems Art to Artificial Life: Early generative Art at the Slade School of Fine Art”, in Brown et al. (eds.), 2008, p. 286f, in which the author claims that the art contributed to the scientific development of computers; and Jones, 2011, especially chapter 1 and 4, in which he argues for the role of artists in the development of new technologies.

⁷² Cf. Robert Zwijnenberg, “Art, the Life Sciences, and the Humanities: In search of a Relationship”, in Ingeborg Reichle, *Art in the Age of Technoscience: Genetic Engineering, Robotics, and Artificial Life in Contemporary Art*, Wien: Springer, 2009, pp. xiv-xxix. See also the social anthropologist James Leach, “‘Being in Between’ Art-Science Collaborations

and a Technological Culture”, *Social Analysis*, No 49, 2005, pp. 141-160. Art is further considered as a catalyst for translating scientific ideas. Cf. Dana Plautz, “New Ideas Emerge When Collaboration Occurs”, *Leonardo*, No 38, 2005, pp. 302-309; Jill Scott (ed.), *Artists-in-Labs: Processes of Inquiry*, Zürich: HGK, 2006; David Edwards, *Artscience: Creativity in the Post-Google Generation*, Cambridge, MA: Harvard University Press, 2008.

⁷³ Jones, 2011, pp. 6-7.

⁷⁴ Brent MacGregor, “Cybernetic Serendipity Revisited”, in Brown et al. (eds.), 2008, p. 92.